

# The TECHNOLOGY DEPT. Chemical Age

VOL LXV

6. OCTOBER 1951

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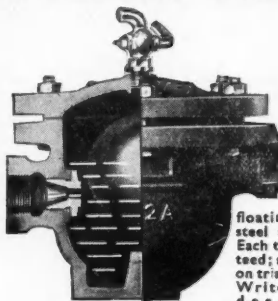
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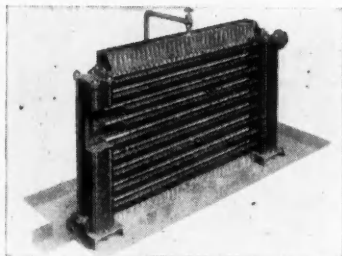
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## INDEX TO ADVERTISERS IN THIS ISSUE

	Page		Page
Bamag, Ltd.	477	Key Engineering Co., Ltd. (The)	Cover iii
British Acheson Electrodes, Ltd.	Cover ii	Leigh & Sons Metal Works	xx
Brough, E. A., & Co., Ltd.	vi	Lennox Foundry Co., Ltd.	xx
		Lord, John L.	Cover iv
Chemapol, Ltd.	iii	Metropolitan-Vickers Electrical Co., Ltd.	Cover iv
Classified Advertisements	xvi, xvii, xviii & xix	Metway Electrical Industries, Ltd.	xv
Clayton, Son, & Co., Ltd.	xiii	Mirrlees Watson Co., Ltd. (The)	xix
Cole & Wilson, Ltd.	xix	Mitchell, L. A., Ltd.	viii
Cruickshank, R., Ltd.	Cover ii	Muirhead & Co., Ltd.	i
Cuthbert, Ralph, Ltd.	vii		
		North, James, & Sons, Ltd.	Front Cover
Derby & Co., Ltd.	xix	Philips Electrical, Ltd.	ii
Drayton Regulator & Instrument Co., Ltd.	xi	Powell Duffryn Carbon Products, Ltd.	ix
Dryden, T., Ltd.	xiv	Power-Gas Corporation, Ltd. (The)	vii
Dunlop Rubber Co., Ltd.	v	Propane Co., Ltd. (The)	xx
		Sandiacre Screw Co., Ltd. (The)	xiv
Electro-Power Service Co. (The)	xx	Simon, Richard, & Sons, Ltd.	iv
		Stanton Instruments, Ltd.	xii
Gas Council, The	x	Steel, J. M., & Co., Ltd.	xv
Guest Industrials, Ltd.	viii	Steele & Cowlshaw, Ltd.	xiv
		Stewart & Gray, Ltd.	iv
Houghton's Metallic Co., Ltd.	xx	Swift & Co., Ltd.	Cover iii
International Pulverisers, Ltd.	Cover iii		
		Ward, Thos. W., Ltd.	479
Kestner Evaporator & Engineering Co., Ltd.	vi & xx	Wardor Chemical Co., Ltd. (The)	xx
		Wilkinson, James, & Son, Ltd.	Cover iii



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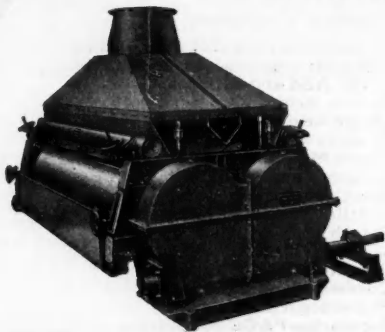
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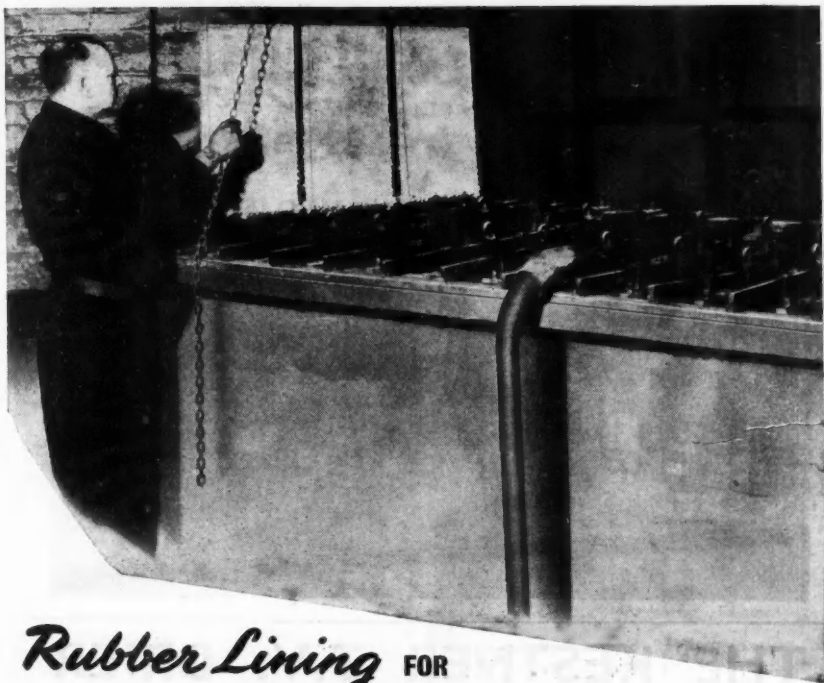
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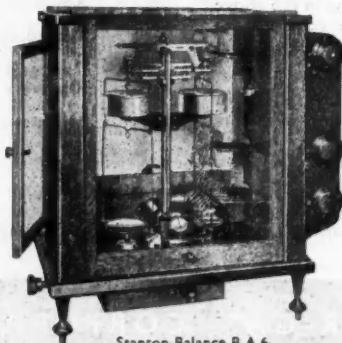
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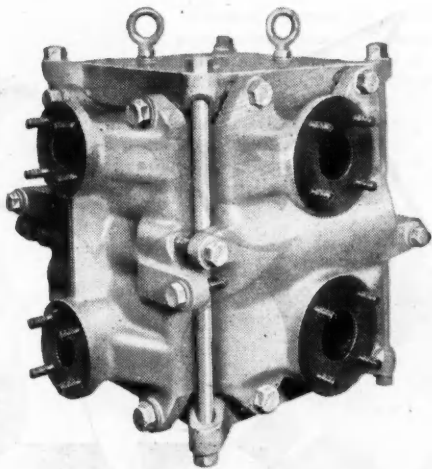
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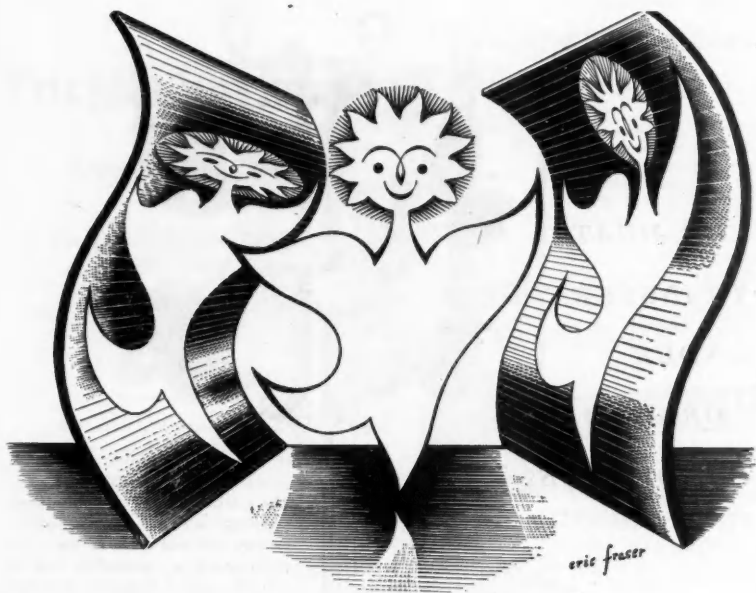
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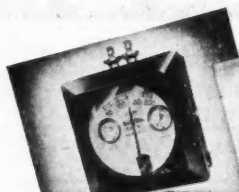
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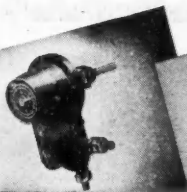
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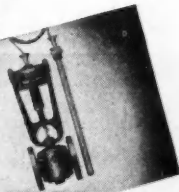
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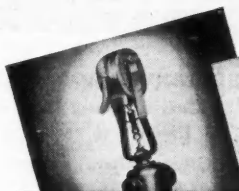
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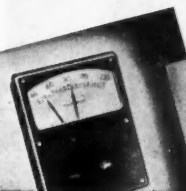
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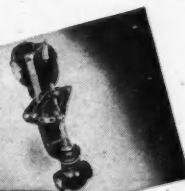
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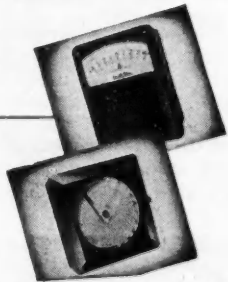


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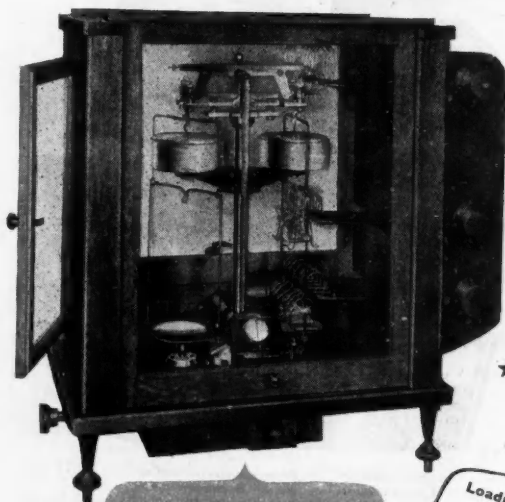
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Volume LXV

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## Reassuring the Public

**D**URING recent months, thanks largely to the Festival of Britain, much more than usual has been seen, read and heard of the tremendous achievements of chemists and the chemical industry over the past 100 years or more. In recent times the public has become increasingly conscious of the fact that they owe a great debt to chemistry and it is doubtful if this appreciation has ever been so acute as it is at the present moment. Through the media of exhibitions, the Press and periodicals, radio, television and the cinema, Mr. and Mrs. Britain now realise that they owe a great deal of their present good health, prosperity and comfort to this science. Unfortunately, however, they are beginning to feel that what they have *gained* on the swings they have *lost* on the roundabouts. There is no doubt that there are many whose respect for the chemist is tinged with a feeling of suspicion and distrust. These people believe that the tempo of modern life increases with every new invention and that with it there comes less contentment and peace of mind. Whether we care to face it or not the fact remains that the public is somewhat resentful of the chemist's

efforts on their behalf and suspicious of his good intentions.

One would think that in the medical field there could be no criticism but even there this is not the case. When one talks of the new drugs found in the chemists' laboratories, it is said that as soon as one is found a new disease crops up. When statistics are quoted to show the great reductions in the mortality rates of certain diseases owing to modern chemotherapy, statistics are quoted to show that nervous, mental and gastric disorders are becoming much more common and scientific progress is made the scapegoat. Criticism is even more common in other fields in which chemistry has played an important role. Everyday someone can be heard abusing 'synthetics.' Things were much better, we are told, before we had 'artificial leather,' 'synthetic bristles,' 'synthetic paints,' etc. To many people the newer products evolved by the chemist will never replace the time-honoured ones whether they be really better or not. More serious are the complaints about food. Every day the newspapers carry letters attacking what the layman loosely calls 'adulteration' and there are frequent cries that

the nation is being poisoned by this or that chemical which has 'contaminated' food in one way or another. There is, too, a growing protest against both air and water pollution.

Apart from the fact that the chemist has helped make life more complicated, the main cause of criticism seems to be that it is largely through his efforts that war has ceased to be a romantic adventure and has become a dreadful nightmare. No one has yet forgotten the horrors of the last world war, and the knowledge that the next one would be immeasurable more terrifying and destructive haunts us all. There is a feeling that some nations have progressed scientifically and industrially much further than they have morally and a belligerent and ghoulish Soviet Russia greatly disturbs a war-sick world. The thought of atomic bombs, poison gas, bacteriological warfare and guided missiles horrifies all but the foolish. Many would like to turn the clock back and live in the days when there were no atomic bombs and, perhaps, no aeroplanes in which to carry them. Unfortunately, we cannot unlearn things, and we cannot have the good without the bad.

Several years ago the Manchester and District Section of the Royal Institute of Chemistry founded the Dalton Lectures. The purpose of these was to bring before the public the beneficial impact of pure and applied chemistry upon contemporary life and so to provide an answer to the charge that science in general and chemistry in particular serve only destructive ends. The seventh Dalton Lecture was delivered by Lord McGowan of Ardeer, honorary president of Imperial Chemical Industries, Ltd., on 27 September and he outlined most admirably the great contributions which have been made by British and other chemists during the past 100 years. The idea behind the lectures is an excellent one and they deserve the very widest publicity. Furthermore, the lecture delivered by Lord McGowan was just what one would expect from this great man. However, without being in the slightest way critical of either the Manchester Section of the Royal Institute of Chemistry or the lecturer, it must be said that the public

needs more than a mere recital of the beneficial achievements of chemistry.

Upon those who can change the face of human society there rests a heavy responsibility. If in their work there are the seeds of suffering and disruption, it is their responsibility to endeavour by all means in their power to prevent such uses. The scientist must strive either to educate mankind to apply only the beneficial properties or uses of his discoveries or to find an antidote to the destructive applications to permit adequate defence against them. In most cases the chemist is trying to fulfil these obligations but, unfortunately, these never receive the publicity they deserve. The average chemist is a quiet, peaceful, conscientious soul and the last thing in the world he desires is to cause suffering or even discomfort. His chief aim in life is to help his fellows. When his discoveries prove other than wholly beneficial he at once starts to work trying to undo the harm.

It is this last fact that we feel the public wants and needs to know, and for this reason we feel that a far less publicised meeting would have served the purpose of the Dalton Lectures most admirably. We refer to the SCI's conference on the 'Problem Arising from the Use of Chemicals in Food' which took place at the Wellcome Research Institution on Thursday and Friday of last week. At this gathering the nation's foremost food, agricultural and pharmaceutical chemists discussed whether or not precautions were needed to safeguard the public from chemical residues and additives. It was generally agreed that there was no need for alarm and that present doubts and fears were largely groundless. It was also agreed, however, that no chances could be taken and every possibility must be thoroughly investigated. Even more important, everyone was agreed that the peace of mind of the consumer was just as important as his health. If those who fear or doubt the chemist could see how seriously the average one takes his responsibilities they would feel completely reassured. We sincerely hope that the papers read and the discussion which took place at this conference will be given the widest possible publicity.

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## Notes & Comments

### Large-Scale Allethrin Output

A MAJOR development recently announced in the United States is the decision of the Carbide and Carbon Chemical Corporation to build a 5 to 6 million dollar plant to manufacture allethrin, the synthetic homologue of one of the natural pyrethrins. The capacity of this new plant will be 500,000 pounds per year, which is greater than the present annual U.S. consumption of pyrethrum. The Defence Production Administration has given a certificate of necessity for the new factory, and no doubt one of the most influential factors was the military priority that for some time now has been absorbing a substantial proportion of the pyrethrum imported from Kenya. The amount of pyrethrum left for domestic insecticide production has been seriously small. At the same time the recent public hearings about toxic residues on and in foods have been creating bigger demands for materials like pyrethrum which combine good insect toxicity with a low human toxicity.

### A Crippling Blow

THE reaction in America to this development has been well summarised by the editor of *Agricultural Chemicals* (1951, 6, 9, 33)—'... we shall no longer have to worry about bad weather or foreign squabbles affecting shipments of flowers to the U.S. It will be the first time that the American insecticide trade has been completely free

from dependence on a foreign source of supply. We think the industry will be better off because of this emancipation.' The reaction in Kenya may not be as cheerful. Pyrethrum flowers are Kenya's largest domestic export and the United States has long been her biggest customer. Only time can show whether the large-scale availability of allethrin will seriously curtail dollar-demand for natural pyrethrum. There is no doubt that the expansion of the pyrethrum-based insecticide market has for years been held back because the natural output is limited. With the current tendency to question more toxic insecticides the future demand for pyrethrum-type products may be big enough to absorb all that Kenya can export together with the 500,000 pounds of synthetic allethrin. Even this could prove to be no more than short-term relief for Kenya's pyrethrum industry for it would not be difficult for the United States to erect another allethrin factory. In the long run this important item in Commonwealth dollar-earning trade must suffer a crippling blow.

### Academic Costs

A MAINTAINED supply of competent scientists and technologists is essential to Great Britain if she is to retain her position in industry and fulfil her re-armament programme. The problem of rising costs at the universities is, therefore, a matter of importance which merits careful consideration.

## On Other Pages

One Hundred Years of Chemistry . . .	453
American Chemical Engineers Meet . . .	459
New Vacuum Gauge for Canned Goods . . .	461
Design in Chemical Factories . . .	463
Indian Developments . . .	465

### Metallurgical Section:

Analytical Chemistry of Less Common Metals . . .	467
Corrosion of Copper Powder . . .	471
Copper and Zinc Allocations . . .	474
Overseas News Items . . .	475
Personal . . .	476
Home News Items . . .	478
Next Week's Events . . .	480

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Financial anxieties about the future were expressed this week by Mr. S. C. Roberts, retiring vice-chancellor of Cambridge University in his address to the Senate. To maintain its activities at the present level, Cambridge University would require an increase in the Treasury Grant of more than £200,000 a year. While the rise in costs affects all universities, the Treasury, in arranging the amount of expenditure to be made through the University Grants Committee made no allowance for any rise in prices, and indeed when discussing the needs for 1952-57 the question of some retrenchment was considered. The number of students at universities is now likely to decline as the needs of ex-service men decrease, but this will not help to save money. Expenditure is mainly on staff, and building in the scientific and technological departments, and the harm done in this direction by cuts, might well outweigh any small financial saving, for any economy which prevents the improvement in education of scientist and technologists can only be deplored. Money spent on the universities should be regarded as an investment which gives more tangible and immediate returns than many other forms of expenditure, and any severe reductions would seem to be both undesirable and unwise in its immediate effects and as a long-term policy.

### Disinfectant Standards

ANYONE foolish enough to read all the advertisements he sees will at some time or another come across the sacred legend—'This disinfectant is ten times as strong as carbolic acid.' Pedants who read more than the first sentence of an advertisement will find immediately following this assertion in letters easily read with a magnifying glass, the qualification—'by the Rideal-Walker test.' The lay public, who does not know what this means anyway, will not notice it is there. Even if it does, it will do little more than wonder idly who Mr. Rideal-Walker was. Those who have heard of carbolic acid (and in this age of soapless detergents, harmless germicides and the rest, their number is decreasing) will note that the stuff kills germs ten times as fast or ten times as

well as carbolic acid, and would probably be impressed if they had not been told so several times before. Those who know not only what carbolic acid is, but what the Rideal-Walker test is, will probably share the viewpoint expressed by Professor H. Berry, chairman of the British Pharmaceutical conference, in his chairman's address recently, that a biological test of this kind, when applied indiscriminately to commercial products, can be nothing but misleading.

### Still Misunderstood

REVIEWING the test and its responsibility for evaluating disinfectants, Professor Berry said that it is still misunderstood and its intentions are warped from those of its authors in 1903. It was also used, or rather misused, in advertisements to gull the layman, but one thing could be said for it—it had kept off the markets so-called disinfectants which were useless, and so acted as a minimum performance test. However, he said, from a clinical viewpoint the test is bad. It consists of comparing the concentration which will kill *Bact. typhosum* in distilled water at 18-20°C. in a specified time, with phenol, and breaks one of the cardinal rules of biological assay—that the compared substances should be similar.

### No Legislation

AS Professor Berry pointed out, it is sometimes impossible to devise any physical or chemical test for a disinfectant, and then a biological test must be used. But when it is used, let like be compared with like, and let there be other tests designed to determine the efficacy and utility of the disinfectant after standardisation, and some body empowered to accept or reject new products on the results of these tests. In this country at present there is no obligation whatever for a manufacturer to give any evidence for the claims he makes for a disinfectant. There should be, as there is in America, a scheme which lays down certain performance tests and definitions in this field, and the Ministry of Health might take upon itself the task of approving genuine products sold on the open market.

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# One Hundred Years of Chemistry

## British Chemists' Contribution to World Knowledge

THE 7th Dalton Lecture was delivered in Manchester on 27 September, by Lord McGowan of Ardeer, K.B.E., honorary president of Imperial Chemical Industries, Ltd. The lectures were founded by the Manchester and District Section of the Royal Institute of Chemistry to bring before the general public the beneficent impact of pure and applied chemistry upon contemporary life, and so to provide an answer to the charge that science in general and chemistry in particular serve only destructive ends.

Following is an abbreviated version of Lord McGowan's address:—

In the field of pure chemistry, Britons have done much to advance the world's knowledge of the composition of matter, of the physical properties of gases and liquids, and the velocity of chemical reactions, and they have thrown a great deal of much-needed light on chain reactions and reaction mechanisms.

### Cornerstone of Prosperity

Investigations of the structure of solid matter, especially crystallography, has been one of the major triumphs of British science, which has also made important advances in electro-chemistry—that is, in the powers of electrolysis. In the same period, British chemists have advanced our general knowledge of the rarer elements, and their discovery of the inert gases may well be said to rank among the greatest pieces of inorganic research of all time.

The story in industrial chemistry is equally inspiring. So great and so rapid has the advance been, and on so many fronts, that today chemistry touches almost every aspect of our lives, individual and national.

Moreover, the influence of chemistry upon the life of the nation has been as great as it has been upon its citizens. Chemical research is, and must always remain, the cornerstone of this nation's prosperity, in peace as in war. In peace, it is the whetstone that puts the fine edge on our competitive efficiency as an industrial nation. In war, it is one of the most important factors in military security.

Our civilisation in 1851 was still largely

built around wood and iron. There were no man-made materials, deliberately created for some specific purpose. Some like polystyrene or polyvinyl chloride were known or soon to be known, but were regarded simply as laboratory curiosities. The two great treasure chests of raw materials—petroleum and coal tar—were completely untapped. The air around us was never thought of as the storehouse of important elements which it is.

### Dalton's Atomic Theory

At the time of the Exhibition, Dalton had already been dead seven years. His atomic theory, which he had expounded in London in 1803, had begun to revolutionise chemical thought the world over, but 48 years later it was more and more visibly in conflict with increasingly more facts. The atom was regarded as the smallest particle of matter—a particle that was indivisible, as its name implies. It is now known that the atom is a world in itself. We study the reactions within it, and are steadily advancing our knowledge of how its vast store of energy may be harnessed and put to use.

One hundred years ago, however, the physical reality of atoms was in doubt, and some chemists regarded them merely as convenient fictions for enabling the great array of empirical fact to be summarised and described. . . . It needed Edward Frankland, in 1852, John Newlands in 1864 and others to lay the foundations of our modern knowledge.

How that knowledge has increased can be gauged from a comparison of the chemist's bookshelves then and now. Henry Watts (later editor of the Chemical Society's *Journal*) had begun in 1847 to translate Leopold Gmelin's *Handbuch* into English, and by 1872 the 18 volumes were all published. The whole of chemistry as it was then known is therein compressed into 8,000 pages which occupy 2½ ft. of shelf-space. This is a measure of knowledge at the beginning of our century. Contrast this with Mellor's already ageing 16 volumes (about 15,000 pages or 3 ft. of shelf-space) for inorganic chemistry, and the 61 volumes of Beilstein so far issued

for organic chemistry (which take up 11 ft. of shelving). On such a measure the knowledge of chemistry is seen to be at least five times greater today than it was 100 years ago.

In 1851, 60 elements were known, compared with 92 today. If comparisons interest you, here is another. In 1883, the known organic chemical compounds numbered 20,000; in 1919 the number was 200,000. Today it is probably half-a-million, but the chance that any new chemical compound made today will be technically useful is, at the most, about 1 in 50.

### Rôle in Medicine

This new chemical knowledge has been applied in no sphere of life more strikingly than in the fields of medicine and surgery. It is perhaps difficult for us to realise what health conditions were like in those days around 1851. The disfiguring marks of smallpox were commonly to be seen on the faces of rich and poor alike. There was also considerable risk of typhus, typhoid and even cholera. The death rate was about 22 per 1,000, or practically double what it is today. In 1832, no fewer than 31,500 people died of cholera in England and Wales; and in the later epidemics of 1848-49 and 1853-54 there were no fewer than 73,400 deaths. It seems hardly credible, when you consider that cholera's victims in this country today number practically nil.

Joseph Lister found that the death rate from sepsis and gangrene in his wards at the Glasgow Royal Infirmary was terrifyingly high, bent his energies to an examination of the cause, and found that living bodies were at the root of it. He began to experiment with carbolic acid, and by his work on antiseptics, thus begun, revolutionised surgery. But it was not until 1880, when the germ theory of infectious diseases was accepted, that medicine could really be said to have abandoned the empirical for the scientific.

Many years before that, Liebig had made this typical and remarkable statement: 'Without a profound knowledge of chemistry', he said, 'physiology and medicine will obtain no light to guide them in the solution of their most important problems—those of the laws of life, the vital processes, and the removal of abnormal states of the organism'. How

right he was to be! Chemotherapy—the treatment of disease by means of chemical substances—has introduced a new and great era of medicine. Organic chemistry has made possible the identification and isolation of the active principles of many vegetable drugs, and by its skill in designing and modifying complex new molecular structures has gone on to open up a vast field of new synthetic drugs, more efficient and less toxic than any of their precursors. A substantial amount of this epoch-making work has been British.

Discovery of the anti-bacterial properties of penicillin by Fleming in 1929 and its development as an antibiotic by Florey and Chain 11 years later are developments too well known for recapitulation in detail. The same may be said of the sulpha drugs, developed largely by British, French and American workers, though the original work was German. The Germans announced in 1935 that Prontosil had proved an effective remedy for diseases due to a certain bacterial species. Curiously enough, they failed to pursue investigations with their usual thoroughness, and it was left to others to show that part only of the Prontosil molecule was essential for anti-bacterial action, and that the true active agent was sulphanilamide, formed by the breakdown of Prontosil in the body.

From this discovery there grew a series of drugs less toxic and of greater therapeutic value than the original—drugs which have given the medical profession a substantial measure of control of diseases in face of which they were singularly powerless before.

### Surgery also Benefited

Surgery has also benefited from chemical research in the realms of anaesthesia and analgesia. The nightmare of pre-anaesthetic days—and they were only just ending when my story begins—was mercifully terminated by the discovery and introduction of inhalation anaesthetics. There can be no gainsaying the fact that the true advance of surgery began with the advent of the anaesthetist, who in turn draws upon chemistry and the chemical industry for his armoury of materials.

In 1851 nothing was known about vitamins. The vitamin-deficiency diseases, like rickets and scurvy, were, however, only too well known to all. In this field of biochemistry, pioneered by Gowland Hopkins,

enormous benefits have been derived from the knowledge of chemistry. The synthesis of new drugs and the production of new materials have been the result of the knowledge of chemistry.

The knowledge of chemistry has also been applied in the fields of medicine and surgery. It is perhaps difficult for us to realise what health conditions were like in those days around 1851. The disfiguring marks of smallpox were commonly to be seen on the faces of rich and poor alike. There was also considerable risk of typhus, typhoid and even cholera. The death rate was about 22 per 1,000, or practically double what it is today. In 1832, no fewer than 31,500 people died of cholera in England and Wales; and in the later epidemics of 1848-49 and 1853-54 there were no fewer than 73,400 deaths. It seems hardly credible, when you consider that cholera's victims in this country today number practically nil.

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enormous strides have been made, with beneficent effects beyond estimation upon the health of all races. Some of the 'accessory food factors' have now been synthesised in British laboratories, and many produced on the commercial scale.

The same story applies to the hormones, for the ductless glands that supply hormones to the living animal were *terra incognita* a hundred years ago. Today, the structures of the hormones are well understood, quite a number have been synthesised, and a goodly selection, natural and synthetic, are on the market.

Before leaving the medical field, I must also mention the success of chemotherapy against two of the most devastating diseases to which the flesh of man is heir—leprosy and malaria. The outlook regarding the former was without hope until 80 years ago, when the Norwegian, Hansen, discovered the micro-organism causing the disease. But it is only really in the last decade, with the development of the sulphone group of drugs that any really dramatic advance has been recorded, and it is with pardonable pride that we can call attention to the major contributions of British chemical research and development in this field.

Equally important results, so far as the tropical and sub-tropical countries are concerned, have followed the success of recent British research into the anti-malarials, which resulted in 'Paludrine', a compound of an entirely new type.

#### First Coal-Tar Dye

Quinine, the extract of a tree bark, was for hundreds of years the only effective treatment for malaria. It was in an unsuccessful attempt to synthesise quinine that the 18-year-old William Henry Perkin, in 1856, made the accidental discovery of the first coal-tar dye, and thereby laid the basis of an industry which, in less than a century, has exerted enormous influences upon our civilisation.

Perkin is generally regarded as the founder of the synthetic dyestuffs industry, but it is permissible to look back over his shoulder to Michael Faraday, another great English scientist who was still alive and vigorous when my century opened, and who is apt to be remembered essentially for his momentous discoveries in the field of electricity, forgetting his great contributions in the field of chemistry. Faraday's

greatest chemical achievement was his discovery of benzene—the starting point of synthetic dyes, to say nothing of aspirin, saccharin and a host of other well-known substances.

The coal-tar dyestuffs industry was born into a comparatively colourless age. Before Perkin's time, all dyes were from natural sources, vegetable, animal or mineral. The opening chapters of a story which begins with Perkin's discovery of Mauveine, in 1856, make exciting reading. For six years or so Britain led the world in the new dyestuffs chemistry, the natural dyes quickly succumbed to the onslaught of synthetic products which combined unheard-of brilliancy of shades with simplicity of application.

#### Discovery Followed Discovery

At first, discovery succeeded discovery with great rapidity. Peter Griess, chemist at Allsopp's brewery at Burton-on-Trent, discovered the diazo reaction upon which the largest group of synthetic dyes—the Azo dyes—is based. Nicholson discovered Phosphine and the Water-Soluble Blues, the first acid dyes for wool, and in the same year Lightfoot discovered the valuable Aniline Black. Then, so it seems, Britain failed to get her second wind. The effort petered out in lassitude and indifference, and the Germans took over the business.

Britain's recovery in the dyestuffs field, begun in 1918, was slow and painful, and may be said to have taken fully 20 years to achieve. But if the way has been hard, the recovery has also been complete.

In the last 30 years the British dyestuffs industry has been responsible for three major discoveries in the world of dyestuffs, and there have been no more than five in all during that period. Britain today is producing more than 2,000 different dyestuffs from indigenous materials, and the crown for dyestuffs chemistry has come back where it belongs.

Plastics were, I should imagine, called into being by the second phase of the Industrial Revolution which demanded, not new techniques for manufacturing things, but new materials for the machines. In 1951 there is available a collection of attractive units of every sort and colour—materials of extraordinary lightness, transparent, translucent or opaque, rigid or

elastic, resistant to heat or corrosion; tailor-made, so to speak, to whatever stipulations may be imposed. In 1851 there were none of these—not in commercial production, anyway. At that time they were working with shellac and gutta percha, ivory, horn, amber and tortoiseshell, but supplies were strictly limited. The first objective of the chemist was, therefore, to produce imitations of these natural materials.

One highly important aspect of his researches concerned that natural plastic, rubber. Thomas Hancock, father of the rubber industry, had discovered the process of vulcanisation with sulphur, and he had found how to make ebonite. Next came the discovery that rubber made a good insulator for electric cables, and by 1870 its use as an insulating medium was well established.

#### Notable Developments

Meanwhile there were notable developments in connection with cellulose. Nitrocellulose had been discovered in 1845, and in the 1860s Alexander Parkes found that nitrocellulose mixed with camphor gave a hard, horny material which he showed at an exhibition in 1862. His work contributed to the invention of celluloid, which led the plastics field for several years.

The modern plastics industry was born in the U.S.A. some time in 1908. In that year Dr. Baekeland patented his process for the manufacture of phenol formaldehyde, but his phenolic resins made only quiet progress for some years.

If in honesty we admit the American origin of the industry, we may also note that some of the greatest advances of the last two decades have been recorded in the U.K. British chemists have done much to elucidate the theory of the polymerisation by which the synthetic materials are formed. The process for making cast sheets of polymethyl methacrylate or 'Perspex' was a British discovery. So, too, was polythene, which resulted from a splendid and courageous piece of research into the effects of high pressures on chemical reactions.

The first hint of the possibility of man-made fibres is contained in 'Micrographia' published by Robert Hooke in 1664. In that book, the celebrated English physicist pointed out that silk was a glutinous 'excrement' which the silkworm forced through an orifice in its body. He went on to suggest

that some 'ingenious, inquisitive person' might succeed in producing a similar fibre artificially.

Nearly 200 years later, at a meeting of the British Association, Louis Schwabe exhibited a fabric woven from glass thread. These threads had been made by drawing molten glass into filaments, and their importance to us lies in the fact that the drawing was done through a form of spinneret—the first recorded use of such a device.

Fibres produced by such means have a high degree of uniformity in their dimensions, and they aroused the interest of Swan, of electric lamp fame, who was urgently seeking a suitable filament material for his invention. In 1883 he invented a process of squirting nitrocellulose solution through a die or spinneret into a coagulating bath of water and alcohol. It occurred to him that these filaments might also have possibilities as textile materials, so he made some very fine threads which were woven and publicly displayed at the Inventions Exhibition of 1885. The essence of Swan's methods were to become the basic principles of synthetic fibre production from that day forward, and his success rekindled interest in cellulose as a starting material in the minds of other researchers.

Next came the epoch-making work of Cross, Beadle and Bevan who, in 1893, discovered how to make viscose from cellulose.

Acetate rayon followed a little later. Then, thanks to the courage and enterprise of the Courtaulds and the work of the brothers Dreyfus at Spondon, near Derby, the great viscose and acetate rayon industries were built up first in this country, then in nearly every part of the world.

#### Protein Fibres

Recent years have seen great developments in the perfection of protein fibres. All manner of materials—milk, soya beans, maize, fish, chicken, feathers and eggs have been used in this work and with varying degrees of success. This country has not lagged behind in this field. 'Ardil', a protein fibre derived from the protein of the groundnut, came into commercial production at Dumfries in February of this year.

Nothing has so far been said about the truly synthetic fibres—a smaller group with greater long-term possibilities than the protein fibres. These synthetic fibres have emerged out of chemical investigation of the

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long-chain molecules. The work of Carothers and his associates in the U.S.A. that culminated in nylon is a milestone by any standards, and American chemists have gone on to make further significant discoveries in this new and richly rewarding field.

In Britain, 'Terylene' the polyester fibre discovered in 1939 by Whinfield and Dickson at Accrington, has now successfully undergone a long period of development, and a plant for its commercial production is due to be constructed at Wilton in North Yorkshire. This fibre will not be confined to textile purposes but will also find numerous industrial applications in such forms as foils, films and moulding powders.

Problems of soil fertility were little understood in 1851, but anxieties about the feeding of a rapidly growing population were there aplenty, and Malthus's prophecy that part of the new population would find 'no place laid at Nature's table' has already taken on an alarming ring.

Liebig—so often seen in the rôle of trumpeter sounding the call to advance, had shown that the growth of crops could be increased by the use of potassium and phosphates, and Lawes and Gilbert had demonstrated, by their experiments at Rothamsted, the critical importance of nitrogen as an ingredient of plant food.

In the middle of the 19th century there were few fertilisers that the farmer could call upon. The one imported fertiliser prior to 1850, was bones.

#### Big Steps Forward

It was Liebig who advocated treating bones with diluted sulphuric or hydrochloric acid before applying them to the soil. This, he said, would convert the insoluble tri-calcium phosphate in the bones into soluble, and therefore readily assimilable, superphosphate. This represented a big step forward. An even greater step was the discovery by Lawes that natural rock phosphates could take the place of bones, which were never available in any great quantity.

By 1851, nitrate of soda had begun to arrive from Chile, and a few farmers were using it successfully. Unfortunately it was expensive. The situation was very similar in regard to guano, the dried excrement and remains of seabirds, which was being imported from Peru. Then, in 1898, Sir William Crookes, in his Presidential address to the British Association, warned the

world that it was living on its capital of combined nitrogen compounds, and forecast a nitrogen famine unless the chemist could step into the breach and achieve the fixation of the inexhaustible nitrogen in the air around us. This was achieved, and the problem of producing large quantities of nitrogenous fertilisers at a reasonable price was thereby solved.

Chemistry has also elucidated some of the problems of soil structure and uncovered some of the secrets of plant growth. Its contribution in the field of crop protection against insect, fungus and weed pests has been equally important and perhaps more spectacular.

#### Selective Weed Killers

Development of the plant growth regulators, or selective weedkillers—work which is substantially British, has occurred mainly in the last decade. The best known of these growth regulators are 'Methoxone' and 2,4-D discovered in 1942 by Templeman and Sexton.

British chemical research has also made considerable progress in its investigations of fungus diseases. The Rubber Research Institute of Malaya has been experimenting with a new fungicide, developed in England, which shows great promise in controlling mouldy rot of rubber trees.

Finally, there is the war against insects. A victorious outcome to this struggle is the concern not of the farmer alone, but of medical men and veterinary surgeons everywhere. In this field, chemical research can view the present situation with pride for it is now known how to control the insects that threaten crops—from the British wireworm to the African migratory locust. The problem is now essentially one of finance and organisation.

It is now possible to control the anti-social insects, and, more important still, the lethal weapons are available with which to control the carriers of the great insect-borne diseases such as malaria, yellow fever, typhus and sleeping sickness.

This encouraging state of affairs has been largely due to the availability of two insecticides. The first of these is DDT; the second, 'Gammexane', gamma-BHC, the product of a British research programme begun in 1942.

There is an urgent need for farmers to use the new weapons and techniques that chemical science has provided for them to

grow more food. It is estimated that British soil alone could be made to yield additional foodstuffs to the value of no less than £180,000,000 per annum, were plant protection remedies applied with all the scientific knowledge already at the farmer's disposal.

#### Daily Developments

Advances of chemistry in this field bring new developments with almost every day that passes. A very recent example is the systemic insecticide, several examples of which are already in commercial production. Such an insecticide, absorbed by the plants, renders their sap toxic for a period to sucking insects. Already it is not too speculative to ponder the large-scale use of systemic insecticides against those insects which attack animals.

Nothing has been said of the technique of refrigeration, which owes so much to chemistry and has revolutionised food distribution in our time, nor of the development of those packaging materials which keep our food clean and safe; nor have I spoken of the cheap soaps and detergents—the products of chemical research; neither have I mentioned the giant cement industry, which has developed on chemical foundations almost entirely within the last century, nor the chemical methods of water treatment which have given us the priceless boon of a safe and palatable water straight from the tap.

With every passing year, more and more compounds of great value are extracted from the seemingly bottomless treasure chest of coal-tar, and now with the advent of the petroleum chemical industry in this country a second treasure chest is opening up.

My survey is, in fact, all too brief, but I hope I have said enough to show that British chemical research still holds that eminent position which it did in Dalton's day. If he were alive, I do not think he would express disappointment with the record of those who came after him, though he was never given to praising lightly.

#### Seven Nobel Prizes

Since the Nobel Prizes were awarded, Britons have won the chemical prize on seven occasions, the medicine and physiology prize on nine occasions, and our 13 prizes for physics are a record for any country. There is the proof—if proof were needed—that we have never lost the qualities that are necessary for permanent leadership in this inspiring field.

## 'Scientists to Industry'

Nash & Thompson, Limited

**M**EMBERS of the trade and technical Press visited the laboratories of Nash and Thompson Limited at Tolworth, Surrey, on Thursday, 27 September and watched work being carried out on a wide variety of scientific and industrial problems. They also saw various stages in the design and manufacture of a number of scientific instruments, and inspected finished products such as the Nash and Thompson Metallurgical Mounting Press, the Paint Research Station's Glossmeter, the Nash and Thompson Flowmeter, the Aeration Test Burner, the Colour Comparator, etc.

Nash and Thompson Limited was founded in 1936 and from then until 1945 the Company was responsible for the design and development of the Frazer Nash gun turret used by the RAF. They also took a leading part in the intensive pioneer development of many types of radar scanner. In 1945 it began to undertake research into problems associated with the design and development of a wide range of products for an important group of companies, and since then its activities have expanded rapidly, so that now its laboratories, workshops, technicians and skilled labour force are available to industry in general.

#### Research and Advice

The Company, with its well equipped laboratories and highly-qualified staff of physicists, chemists and engineers, now investigates and advises on such problems as corrosion, electro-plating, paint finishes, chemical and metallurgical analysis, colour matching and electronics. In addition, they also design and manufacture single instruments to suit users' special requirements, as well as produce a standard range of specialised scientific apparatus. Physics, chemical, metallurgical and engineering laboratories work in close harmony with a design and drawing office, machine and fitting shops, an experimental shop and a pattern shop so that the work of the research worker can be carried through all stages until a prototype is produced and/or complete sets of details and schedules are ready for use in the firm's or their clients' shops.



# American Chemical Engineers Meet

## Technical Papers Read at Annual Conference

THE president of the University of Rochester, Dr. C. W. de Kiewiet, delivered the address of welcome at the opening of the national meeting of the American Institute of Chemical Engineers at Rochester, New York, on 17 September. The meeting took the form of a three-day convention and was attended by several hundred chemical engineers from the United States and Canada.

Features of the convention were discussions on the engineering manpower shortage, chemical plant maintenance, industrial applications of photography and chemical engineering education.

A photographic exhibit designed to show the functional use of photography in design, research and development work, and photography as an aid to engineering report writing, was on display.

A paper was presented on 'Metering Liquid Sulphur' by Messrs. J. R. West, E. S. Boe and C. E. Butterworth, of the Texas Gulf Sulphur Company and the Mellon Institute. The use of head meters, area meters and calibrated weirs were said to represent new developments in the metering of liquid sulphur. Orifice plates with three different orifice diameters were used in a one-inch steam-jacketed pipe. Measuring the differential pressure proved to be the problem but the use of a special manometer made the use of this meter feasible. After coefficients of discharge had been calculated by calibration from a standard tank, accuracy was found to be within 3 per cent.

### Discharge Coefficients Lower

A one-inch Venturi meter was used with the same type of manometer as with the orifice meter. The discharge coefficients obtained here were as much as 18.5 per cent lower than those found in the literature for the same Reynolds numbers.

In the calibration of a rotameter, sulphur was pumped through the meter both with and without back pressure. Over the range studied this meter was accurate to approximately 2.5 per cent. Severe problems presented themselves in the use of a rotameter, such as those connected with corrosion due to moisture in the sulphur, plugging of the area meter due to extraneous material, and

extremely high temperatures, which raised the viscosity of the liquid sulphur too high.

Weirs with rectangular and V-notches were cut from 1/32 in. stainless steel and these weirs calibrated against a standard tank. The V-notch weirs with an angle of 60° and 90° did not prove to be as accurate as a 90° weir, which was accurate to within 0.4 per cent. A rectangular weir was accurate to 1.7 per cent.

### Oscillating Piston Meter

An oscillating piston meter was used in the range from 1 to 7 gallons at pressures up to 150 p.s.i. The meter was used in a steam-jacketed vessel which kept the sulphur liquid. This meter is simple of construction with one-way flow through ports which are always open. This meter performed with accuracy better than 2 per cent.

The last type of meter was a proportioning piston pump which had its cylinders immersed in liquid sulphur and which delivered to a steam-jacketed line. Delivery at high back pressures was slightly lower than the calibration, but at low back pressures the pump calibration proved correct. The worst error was 3.7 per cent.

Another paper, 'Solvent Drying', was presented by R. S. Mitchell of the California Research Corporation. In the operation of processing equipment which uses methyl ethyl ketone/benzene solvents (said Mr. Mitchell) it is often desirable to control the amount of water in the solvent, or in some cases maintain it essentially water-free. A drying system is required because sometimes water is brought in with the feed. This paper presented a distillation method for the removal of water from methyl ethyl ketone containing benzene or naphtha.

The drying of methyl ethyl ketone alone cannot be done satisfactorily by distillation because of the small difference in composition of the water/methyl ethyl ketone minimum boiling azeotrope, and methyl ethyl ketone saturated with water at condenser temperature.

The presence of benzene facilitates drying the solvent by distillation because it accomplishes phase separation of the overhead distillate. In the methyl ethyl ketone/benzene/water system a ternary azeotrope exists



as a minimum boiling mixture at 156°F. which upon condensing separates into two layers with the following composition:—

	Weight per cent at 25° C. of	
	Upper Layer	Lower Layer
Methyl ethyl ketone .. .. .	19.0	3.5
Benzene .. .. .	80.6	0.1
Water .. .. .	0.4	96.4

The upper layer is 91.1 per cent by weight of the azeotrope.

It is not practical to dry methyl ethyl ketone containing from 10 to 30 per cent benzene. This paper presented laboratory operating and equilibrium data for determining the desired enrichment of benzene and water in order to accomplish solvent drying by separation of a water phase.

An Othmer-type equilibrium still was used to determine vapor-liquid equilibria for 90 per cent methyl ethyl ketone/10 per cent benzene, containing small quantities of water. For equilibrium data in the region of two-phase separation a Gillespie still was used with a modified method of operation. The equilibrium data obtained was plotted in a manner to permit use of a McCabe-Thiele plot to determine the number of theoretical plates required for drying.

Several laboratory runs using a distillation column were made to substantiate the data. The results indicated that the data and determination of number of theoretical plates are sufficiently accurate for the design of a commercial column.

Operating results for a 30-plate commercial column show that plate efficiencies for the water stripping and enriching sections are less than those which can be calculated by the method of Geddes, but the plate efficiencies obtained when enriching benzene are higher than those obtained by the Geddes method. An 80 per cent efficiency was obtained in the commercial column.

The McCabe-Thiele method of calculation was checked by plate to plate calculations, and the analysis as two separate two-component systems was found to be satisfactory for design purposes.

Application of solvent drying as part of a wax de-oiling plant was also discussed.

## Training in Use of Instruments

AS the complexity of industrial instruments increases, the necessity of providing users with an adequate explanation of the theory and practice of instrumentation becomes

more apparent. George Kent, Limited, of Luton, have for many years made a practice of giving an extremely thorough training to individuals sent to the works by user firms. Kent's have now begun a series of integrated courses for instrument mechanics and engineers from customers, to give this training on a more centralised basis.

The courses last for four or five weeks, depending on the requirements of the trainees, during which period whole-time instruction is given by a qualified training staff on the theory, operation and maintenance of a wide range of Kent instruments and control apparatus. A workshop and lecture room have been specially provided and equipped for training courses at the Luton Works, so that trainees get the full benefit of working and comparing notes together.

First results have been most encouraging, and there is now a greater demand for places on the courses than can be satisfied in the immediate future.

## Multi-Language Newspaper

THE world's first multi-language newspaper in the field of metal science has been authorised for publication by the American Society for Metals.

The Society's Board of Trustees has allocated \$50,000 to finance two-year preparation towards production of an 'International Journal of Metal Science,' and two experts from each of 22 nations are being selected to set publication policy at a special session of the first World Metallurgical Congress in Detroit, 14-19 October. The Detroit conclave is sponsored by the Society and is expected to attract more than 40,000 metal engineers, research scientists and managing executives.

The organisation's Board of Trustees will be publishing agency for the new paper until a world representative Board of Governors is selected. The new paper will appear in original languages of contributing writers and experts. Abstracts in English will be prepared by a staff yet to be selected.

## Indian Coal for Britain

Some 120,000 tons of coal are reported to have been sold to the National Coal Board by the Bengal Coal Company and the Equitable Coal Company of Calcutta. The coal, it is understood, will be used for gas production and is to be shipped to Britain.

# New Vacuum Gauge for Canned Goods

by J. C. Morpeth, British Food Manufacturing Industries Research Assoc.

THE most commonly used method of measuring the vacuum in canned goods is that of puncturing the can or the tin lid of a glass vessel with a vacuum gauge fitted with a hollow steel needle enclosed in a rubber ferrule. Other methods have been suggested, but the puncturing gauge method remains the most convenient, although it is liable to give erroneous results.

Apart from the errors of the gauge itself, i.e., calibration or mechanical faults, there is always present an error due to the presence of air at atmospheric pressure in the gauge. On measuring the vacuum in a package with an ordinary can-piercing gauge, the value obtained from the scale reading is that resulting from the mixture of air in the gauge with that in the headspace of the pack. It therefore follows that any measurement of vacuum obtained with the puncturing gauge is always lower than the true value to an extent depending upon the internal volume of the gauge and the volume of the headspace in the can. The smaller the volume

the Budenberg Gauge Company, who are now manufacturing the instrument. The gauge has been patented in England and certain other countries.

The theoretical errors in the gauge readings when a gauge of known internal volume is used to measure the vacuum in a headspace of known volume can be simply calculated from the formula:—

$$P(V_1 + V_2) = p_1 V_1 + p_2 V_2$$

Where  $V_1$  = Internal volume of the gauge;  
 $V_2$  = Volume of the headspace in the can;  
 $p_1$  = Pressure of air in the gauge (atmospheric);  $p_2$  = pressure of gas in the can = (atmospheric pressure minus the vacuum);  
 $P$  = Final pressure in the can when the can and gauge are connected.

Assuming that a gauge has an internal volume of 5 c.c. (a not uncommon value), and that the barometric pressure is 30 in. of mercury, the vacuum which would be read from the gauge when used on cans of known headspace and vacuum has been calculated with the results:

True Vacuum (inches Hg)	Volume of Headspace (in c.c.)								
	100	75	50	25	15	10	5	4	2
25	23.8	23.4	22.7	20.8	18.8	16.7	12.5	11.1	7.2
20	19.1	18.8	18.2	16.7	15.0	13.4	10.0	8.9	5.7
15	14.3	14.1	13.7	12.5	11.3	10.0	7.5	6.7	4.3
10	9.5	9.4	9.1	8.3	7.5	6.7	5.0	4.5	2.9
5	4.8	4.7	4.6	4.2	3.8	3.4	2.5	2.3	1.5

of the headspace in a can, the greater the error in gauge reading with an ordinary vacuum gauge.

This defect of the ordinary can-piercing gauge has long been known to the chemists and technologists of the canning industry. It was again forcibly brought to their notice during the last war when certain canned foods prepared under Government contracts were required to be packed under a specified minimum degree of vacuum. Canned foods given processes of heat exhausting or cold vacuumising which should have given the required degree of vacuum, were found to be low in vacuum, according to the available method of testing. The British Food Manufacturing Industries Research Association was asked to investigate methods for more accurately measuring the vacuum in canned foods. The modified vacuum gauge, now known as the FIRA Gauge, was the outcome of this investigation and collaboration with

From these theoretical results it is apparent that the greatest errors will result when the true vacuum in the can is high and the volume of the headspace is small. With low vacuum the error is not so great provided that the headspace is large, but when the volume of the headspace approaches that of the gauge, the relative error again becomes great.

It would be possible to calculate the true vacuum in a can from the vacuum gauge indication as normally obtained provided that the internal volume of the gauge were known, and also that the volume of the headspace could be accurately measured. The measurement of the volume of the headspace in a can is not, however, a simple matter. As in most cases the actual volume is governed to a greater or less extent by the degree of vacuum because of the flexibility of the lid of the can, an accurate determination of the headspace volume by

direct measurement would not be possible.

Suppose, however, that having made a determination of the vacuum in a can in the usual manner with a puncturing gauge, a second known volume of air at known pressure and at the same temperature as the headspace gas is introduced into the system. With the vacuum gauge still in position on the test can, a second gauge reading is obtained. From these two readings it is possible to calculate the original vacuum in the can without requiring to know the volume of the headspace. The calculation is made in the following manner.

Let the volume of the headspace in the can =  $V_c$   
 Let the vacuum in the headspace in the can =  $P_c$   
 Let the volume of the gauge =  $V_1$   
 Let the volume of the air introduced =  $V_2$

The pressure of the air in the gauge before puncturing the can is atmospheric; let this pressure =  $p$ , and let the extra air introduced be at the same pressure.

### Two Readings

*1st Step.* Piercing the can with the gauge in the normal manner, a gauge reading is obtained =  $P_a$ .

Then  $(V_c + V_1) P_a = P_c V_c + V_1 p$ .

The term  $V_1 p = 0$  because in measuring vacuum, atmospheric pressure  $p$  is taken as zero.

$$\text{Thus } V_c = \frac{P_a V_1}{P_c - P_a} \quad (1)$$

*2nd Step.* With the gauge still in position, a volume of air  $V_2$  at atmospheric pressure  $p$  is introduced. A second gauge reading  $P_b$  is obtained.

Then  $P_b(V_c + V_1 + V_2) = P_a(V_c + V_1) + V_2 p$ .  
 (As before the term  $V_2 p = 0$ )

$$\text{or } V_c = \frac{P_a V_1 - P_b V_1 - P_b V_2}{P_b - P_a} \quad (2)$$

Combining equation (1) and (2):

$$P_c = \frac{V_2 P_b + V_1 P_b - V_1 P_a}{V_2 P_b + V_1 P_b - V_1 P_a}$$

If  $V_1$  be made equal to  $V_2$ , i.e., the volume of the air introduced at the second step is equal to the internal volume of the gauge:

$$P_c = \frac{P_a P_b}{2P_b - P_a} \quad (3)$$

Thus, assuming that the volume of the headspace does not alter during the operations, it is possible to calculate the true vacuum from the two gauge readings with-

out requiring to know the volume of the headspace in the can.

In order to admit the necessary volume of air to the system of gauge and can, as postulated in the above theoretical discussion, some practical method is required. In the FIRA Gauge this has been accomplished by providing an auxiliary air reservoir exactly equal in internal volume to the internal volume of the gauge itself. A Schrader tyre valve, actuated by a button at the back of the gauge, is employed for effecting communication between this air reservoir and the gauge space.

The mode of operating the FIRA Gauge is extremely simple:—The button at the back of the instrument is pressed and released, thereby ensuring that the air in the auxiliary chamber is at atmospheric pressure and the chamber is again closed. The can is then punctured in the normal manner, after first moistening with water the surface of the rubber ferrule enclosing the puncturing needle.

When the perforation has been effected, the pressure of the hand on the gauge is released slightly, care being taken to avoid breaking the seal between can and gauge. The metal case of the gauge is then gently tapped, and when the indicating needle is steady the gauge reading is noted. With the gauge still in position on the can, the button is again depressed and released. The air in the reservoir is thus put in communication with the internal space of the gauge and the headspace of the can. The gauge case is again gently tapped, and the second and lower gauge reading is noted. From these two readings the true vacuum in the can is calculated from the formula:—

$$\begin{aligned} \text{True Vacuum} \\ &= \frac{\text{1st Reading} \times \text{2nd Reading}}{\text{Twice 2nd Reading} - \text{1st Reading}} \end{aligned}$$

In order to obviate making this calculation arithmetically, a calculator has been designed on the principle of the slide rule, from which the true vacuum may be read off after setting the first and second gauge readings.

### Results Good

Results obtained using this method were good. Meat paste jars were filled with water to give a headspace of approximately 9 c.c., sealed under accurately known vacua.

[continued on page 464]

# Design in Chemical Factories

## Building Research Congress Hears Papers

TIME was when architects considered it beneath their dignity to plan a factory. Yet to-day such commissions are eagerly sought, and such is the importance of industrial architecture that an entire session of one of the Divisions of the Building Research Congress, which was held in London last month, was devoted to the planning of factories. The papers presented by British and American experts covered almost every aspect of factory layout including the selection of sites, the flow of materials, transportation facilities, personnel requirements, administrative facilities and architectural design. Planning in relation to working conditions was the subject of a paper by G. P. Barnett, H.M. Chief Inspector of Factories, London, who discussed the intelligent layout of the factory and its ancillary buildings cleanliness, temperature and ventilation, noise, etc.

An eminent American architect, F. A. Fairbrother, pointed out that in planning for flow of materials an architect may offer very valuable aid. Because of the facility which comes from practice in solving problems of plan and space, he often comes up with surprisingly simple and practical suggestions.

Not only did the papers deal generally with the different methods of factory construction and their costs in relation to space requirements, natural lighting, heat insulation, ventilation, maintenance, etc., but consideration was also given to the important constraints imposed by different types of manufacture, including the production of chemicals.

### An Expensive Practice

As stated by Edward D. Mills, a London architect, the pace of modern industrial development is such that the most up-to-date process to-day may be regarded as obsolete in five years' time. Many manufacturers have therefore come to the conclusion that the solution is the erection of makeshift buildings which in theory can be scrapped after a few years. In practice, such buildings are expensive to erect, and because of the high cost of servicing, heating and maintenance etc., are finally accepted as permanent but unsatisfactory substitutes for existing buildings.

Mills suggests two possible alternatives. The first is the construction of properly designed semi-permanent buildings with a light structural frame, and standardised wall and floor infilling panels which can be arranged in a variety of plan forms and ultimately dismantled when their term of use has expired, the units being subsequently available for re-erection elsewhere in a different form. The second alternative is the construction of industrial structures as permanent weatherproof envelopes, housing a flexible, interchangeable and independent framework for the developing process, allowing a complete reorganisation of machinery or plant, without interference with the building structure at any time. This approach is regarded as particularly appropriate to the chemical industry, where particular products or manufacturing processes may have a very short life.

### Careful Selection Essential

On the subject of maintenance, Mills emphasised that the materials used in the construction of any factory building should be selected with great care in relation to the conditions under which they will be used, the durability required, and the possible need to maintenance and repair. Giving a few obvious examples, he pointed out that exposed steelwork should not be employed where corrosive fumes are likely to be present, where chemicals are used in large quantities, or where a high level of condensation is anticipated. Steelwork should be encased where a process has a high fire hazard, or, alternatively, reinforced concrete should be considered as a structural material.

A major problem is presented by the shortage of steel, aluminium, timber and cement. The construction technique used in factory building must use these scarce materials as economically as possible. Recent developments in structural technique show considerable savings in these materials over traditional building methods and their use will have considerable influence on the planning and construction of factory buildings. The use of high tensile steel, welded structural steelwork, pre-stressed reinforced concrete, shell membrane reinforced concrete, and factory-made standardised floor and

wall units has passed the experimental stage in most industrialised countries and is already changing the shape and appearance of factory buildings. Considerable research is still needed in relation to the most economical applications of these new techniques. Mills, therefore, considers that industrialists should be encouraged to experiment in these fields, since the work already carried out suggests that their use can materially assist in the development of more economical and efficient manufacturing units.

Chemical manufacturers, in common with many other industrialists, are endeavouring to expand their production as rapidly as control restrictions permit. Particularly welcome, therefore, is the realistic approach to the problems of industrial architecture which was so much in evidence at the Congress. Fairbrother claimed that the better industrial architecture was well in advance of much modern commercial building design. This close co-operation between architecture and industry should be of inestimable value in the future progress and expansion of chemical manufactures.

## Building New Factory

### Expansion Made Necessary by Demand

**A**LTHOUGH a post-war reorganisation of their existing factory has enabled L. Oertling, Ltd., to increase their production even when compared with the wartime output, a continuing and growing demand for Oertling balances has made the provision of a larger and more modern works an urgent necessity.

The construction of a new factory has commenced. It is located at St. Mary Cray and will be fully equipped with the most up-to-date machine tools for the production and finishing of balance components, and specialised instruments of recent design for the testing of balances and the adjustment of weights.

Ideal working conditions with full canteen facilities will be provided in rural surroundings and the entire factory, which is pre-cast concrete, with a barrel-vault roof and north-light construction, will be temperature-controlled.

Air-conditioned, temperature-controlled balance rooms entered through specially constructed air locks will be provided for the

adjustment and standardisation of balances and weights.

The research laboratories at present in London will be located at the factory providing increased space and facilities for the investigation of problems of balance design.

The total covered area of the factory will be nearly 33,000 square feet.

## Chemical Microscopy Meeting

A JOINT meeting of the Microchemistry Group of the Society of Public Analysts and Other Analytical Chemists with the Liverpool and North-Western Section of the Royal Institute of Chemistry will be held in Liverpool on Thursday, 18 October.

Members of the North of England Section of the Society of Public Analysts are invited to take part in the programme which includes afternoon visits to Lever Brothers, Port Sunlight, Ltd., and J. Bibby & Sons, Ltd.

The evening meeting will be held at 7 p.m. in the chemistry lecture theatre of Liverpool University, Brownlow Street, when the following papers will be read and discussed:

'Some of the Principles of Quantitative Microscopical Analysis', by J. G. A. Griffiths; 'Some New and Simple Techniques for the Application of Fluorescence Microscopy', by J. King (Department of the Government Chemist); and 'Applications of Polarisation in Chemical Practice', by H. H. Hartshorne (University of Leeds).

## New Vacuum Gauge

*continued from page 462*

and the vacua tested with the FIRA Gauge. The following results were obtained. The values recorded under '1st Reading' would be equivalent to those obtained with the ordinary puncturing gauges in common use.

Applied Vacuum (in.)	1st Reading (in.)	2nd Reading (in.)	Calculated Vacuum (in.)	Error	
				1st Reading (in.)	Calculated Vacuum (in.)
9.1	6.4	4.9	9.2	-2.7	+0.1
13.2	7.9	5.7	12.9	-5.3	-0.3
18.9	11.8	8.5	19.3	-7.1	+0.4
20.1	14.3	11.3	19.5	-5.8	-0.6
24.0	17.2	13.4	24.0	-6.8	0

The author wishes to record his thanks to the Council of the British Food Manufacturing Industries Research Association and to the Department of Scientific and Industrial Research for permission to publish the results of this investigation.

## Indian Developments

(From Our Own Correspondent)

THE Government of India have appointed a five-man committee to examine and suggest concrete proposals for the establishment of a fine zinc smelter industry in India.

The committee's functions will be to recommend steps to assess the resources of zinc ores at Zawar (Rajasthan) and other places in India; to recommend location for one or more zinc smelting plants and the methods to be adopted; to recommend the agency to be placed in charge of smelting and the advisability of entrusting this to the Metal Corporation of India, keeping technical and financial aspects and the existing legal commitments in view.

A scheme for Indo-German industrial co-operation, which has been approved by the Government of India, is being finalised in consultation between the Indian Legation in Bonn and concerned German industries. The scheme envisages the visit of a German Technical Mission to India to explore the ways of German assistance to Indian industry. It also includes technical training of Indian personnel in Germany with reciprocal arrangements for Germans to study Indian philosophy.

\* \* \*

Extensive deposits of ilmenite sand have been found in Ratnagiri District in Bombay State of India. These deposits together with the well-known beach sands of Travancore, are expected to offer India a place of pride in world trade of the much needed mineral.

\* \* \*

India is to have a third big aluminium factory. The two principal aluminium factories in India which to-day account for an annual production of 3,678 tons are now investigating plans for the expansion of the industry in the country. The estimated requirements of India are in the neighbourhood of 15,000 tons per annum. Lack of adequate power supply is one of the reasons for inability to take the industry to its present installed capacity. The firms have approached the Government of India for assistance. It may be remarked in this connection that the Government of India have decided that no subsidy need be given to the industry as the Indian prices compared favourably with those of imported materials.

## Tin-Nickel Plating

Remarkable Resistance to Corrosion

THE newly invented tin-nickel electroplate remains permanently bright when exposed to the atmosphere or to many liquids and sprays that corrode other metals. The resistance of this tin-nickel plate to corrosion is so remarkable that it is to be classed not simply as a decorative plating, but as a material of construction in chemical engineering plant. The distinction implied is that tin-nickel is not merely a coating that remains bright and decorative under conditions which would tarnish or rust steel, brass and other common metals, but that it is exceptionally resistant to concentrated solutions of many acids, alkalis and salts.

The evidence for this conclusion is given in 'Electro-deposited Tin-Nickel Alloy Coatings' issued recently by the Tin Research Institute, which describes work done in the Institute's laboratories during the past two years. The first part relates to the method of the electrodeposition process and shows that the operating conditions are sufficiently flexible to ensure good sound deposits in actual workshop practice. The second part, dealing with the corrosion tests, puts forward an explanation of the remarkable corrosion-resistance of the alloy, which could not be predicted only from a knowledge of the corrosion-resistance of tin and nickel separately. From this it is plain that a new permanent decorative plating has been born. Copies of the booklet (which is written by N. Parkinson, M.Sc., A.R.I.C., S. C. Britton, M.A., and R. M. Angles, L.I.M.) are available without charge from the Tin Research Institute.

## High Temperature Flame

A flame that can quickly burn a hole through the most fire-resistant material has been demonstrated by scientists at the Temple University Research Institute in the U.S.A. A tiny blue flame of hydrogen and fluorine is said to have a temperature of between 9,000° and 9,500°F. and is believed to be among the highest sustained laboratory temperatures ever obtained. University scientists have also developed a torch that burns powdered aluminium in oxygen. It can penetrate a 3-in. concrete wall in two minutes.



## Smoke Abatement

### Annual Conference Held

FROM 26-28 September the National Smoke Abatement Society held its annual conference at Blackpool. Smoke in all its aspects was discussed, from the use of smokeless fuels in domestic grates to the waste of energy involved in the production of smoke.

The 2nd Des Voeux Memorial Lecture this year was given by Dr. J. Bronowski, director of the Central Research Establishment of the National Coal Board, and his subject was 'Power and Waste in their Social Setting'. Stressing the wastage of energy involved in inefficient plant, smoky appliances and antediluvian methods, he said that we must learn to save energy by modernising plant, revising layout and sequences in all industrial operations, and, above all, by instituting new processes. He hoped, he said, that atomic fuels would arrive within 25 years, but meanwhile there was a wealth of energy waiting to be tapped in the 17 cwt. in every ton of coal whose energy went up the flue. This energy was in the soot on the boiler, in the steam that goes to waste in the cooling towers, in the smell round the gas works, and in every other inefficient appliance in factory and home.

Shortage of raw materials, he declared, was more serious than shortage of energy, but the new processes and techniques required to supplement raw materials needed greater amounts of energy. Dr. Bronowski said that we had the scientists to supply this, but we were short of technologists who could translate scientific developments from the laboratory to the factory.

### Power & Products from Lignite

THE U.S. Bureau of Mines has recently announced a new process for obtaining power and coal tar products from lignite and other non-coking coals. Major products of the process, which is a variation of low temperature carbonisation, are a high heating value char—ideal says the report for power plant use—and crude coal tar. The process is applicable to any coal of lower grade than highly volatile bituminous B.

More favourable coals will yield as much as 45-55 gallons of tar oil per ton. The char remaining will compete in America with natural gas as a fuel, and the Alumin-

ium Corporation of America is erecting a new aluminium smelting plant in Texas with a capacity of 85,000 tons of metal yearly, to be powered by steam-driven equipment using lignite as a fuel processed by the new method. In the process, the lignite is crushed, dried by boiling at 350°F., and burned in air at 950°F. to extract the tar oils and obtain a char. Overall thermal efficiency is reported to be about 91 per cent.

The process is also applicable to synthetic liquid fuel production, since the tar oils can readily be hydrogenated using relatively little hydrogen, and the carbonising equipment can be used to extract oil from oil shale fines at present discarded because they cannot be handled in most of the pilot plant shale retorts under study.

### U.S.A. Chemical Exhibition

THE 23rd Exhibition of Chemical Industries will be held in New York, at the Grand Central Palace, from 26 November to 1 December. The exhibition was first inaugurated following the outbreak of the first world war and is sponsored by an advisory committee of leaders in the major fields of interest served by exhibitors. Mr. E. R. Weidelin, Director of the Mellon Institute, is chairman of the committee for the 1951 exhibition.

The purpose of the Exhibition of Chemical Industries is to provide a common meeting ground for management, research and production personnel, stimulated by displays of raw materials, machinery and products and aided by demonstrations of equipment and actual processing operations. It is a biennial fixture, designed to implement the specialist in his own field and also to refresh his knowledge in outside spheres.

The field of the exhibition comprises the production of chemicals, the entire range of chemical processing, and the use of chemical ingredients and chemical steps in connection with mechanical operations of all kinds, literally affecting all industries. Exhibits include a great variety of raw, partially manufactured materials, processing machinery and equipment for all sorts of manufacturing plants, also displays of apparatus and instruments used in research and in process control.

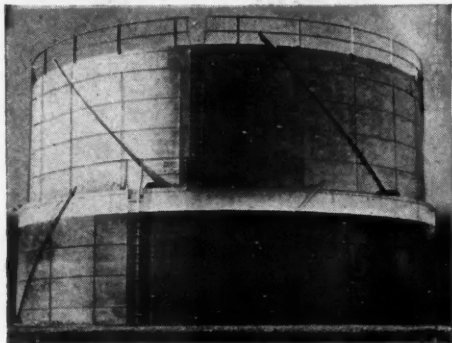
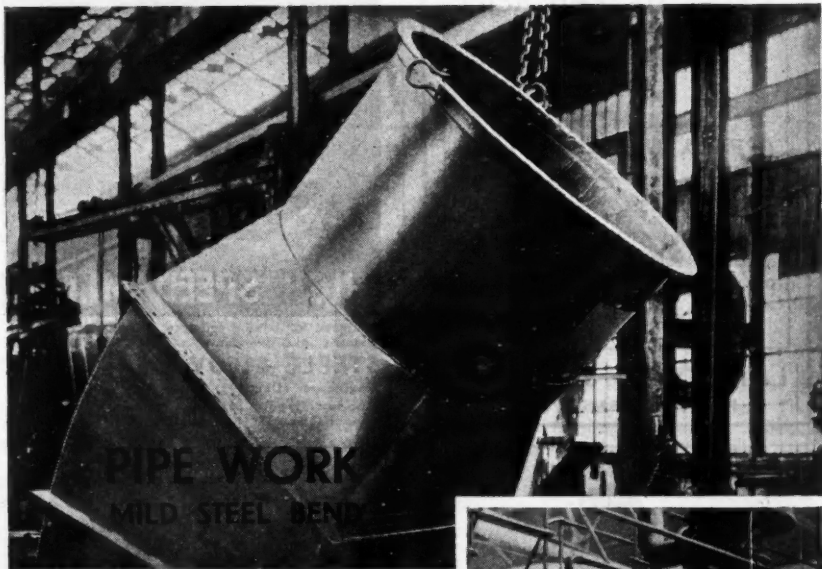
An announcement has just been released that 381 concerns with 400 exhibits will occupy all available exhibit space on four floors of the Grand Central Palace.



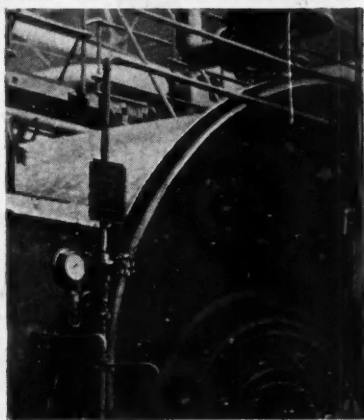
# Metallurgical Section

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## Metallurgical Section

### Analytical Chemistry of the Less Common Alkali Metals

#### Part II—Rubidium & Caesium

by T. S. West, B.Sc., A.R.I.C.

RUBIDIUM and caesium closely resemble potassium in their reactions, all the common tests for the last element being duplicated by the former two. Indeed, so alike are the metals that they were only recognised as new elements as late as 1860-61 by Bunsen and Kirchhoff, from spectroscopic evidence, and even to-day, chemists are still content to turn in rubidium and caesium with their potassium analyses unless they have recourse to spectral methods.

An extensive search of the literature reveals, however, that there are many methods available for distinguishing between potassium, rubidium and caesium, and for determining rubidium and caesium in the presence of potassium. Nor is the separation of rubidium and caesium as difficult as is commonly believed. Russian workers have been very prominent in this field, and particular attention has been paid here to their work. As would be expected, however, such a study has revealed much contradictory evidence in the literature, and the author has attempted to steer a middle course wherever possible.

Potassium, rubidium and caesium yield insoluble precipitates with chlorplatinic acid, and since all three precipitates are yellow, this reagent cannot be used to differentiate potassium from rubidium and caesium. The chlorplatinate of the latter two ions are less soluble than potassium chlorplatinate, however, and a saturated solution of the latter has been used to detect rubidium and caesium in the presence of potassium.<sup>1</sup>

A modification of the chlorplatinate test can be employed to distinguish between rubidium and caesium in the presence of all the other alkali metals. The test is carried out by adding one drop of a one per cent solution of cadmium iodide plus one drop of

0.5 per cent chlorplatinic acid, to one drop of test solution containing the alkali metals. In the presence of caesium, the solution turns red and deposits dark red micro crystals of a compound of caesium, cadmium, platinum and iodine. The authors<sup>2</sup> of this test claim that none of the other alkali metals interfere.

Rubidium and caesium readily form double salts with the halides of stannic tin. This is often used to distinguish between rubidium and caesium, and potassium. The precipitates have the composition  $M_2SnX_6$ , where M may be rubidium or caesium, and X chloride, bromide or iodide. Stannic chloride is used in one scheme proposed in the literature for the detection of rubidium, caesium and thallium (which closely resembles the first two in its chemical reactions) as follows.<sup>3</sup>

One drop of potassium iodide solution is spotted on filter paper, and the spot covered with one drop of tin solution plus one drop of the solution to be tested. A little potassium iodide solution is added to the centre of the spot from capillary tubing. If the spot begins to darken, caesium is present. This is due to the insolubility of the double salt of tin with caesium, in potassium iodide solution. A better caesium test is obtained by previous removal of thallium as the iodide.

To detect rubidium, both caesium and thallium should be removed by precipitation as their bismuth iodides, after which the rubidium is converted to the black insoluble compound  $Rb_2AuPdCl_6$ , by adding a few drops of an auric chloride, palladous chloride solution. Under the microscope these crystals can be seen as characteristic black octagons. The detection limits are 0.03  $\mu$ g. for caesium and 0.15  $\mu$ g. for rubidium, using

a ten per cent auric-palladous chloride solution.<sup>4</sup> The other alkali metals do not interfere with the test, but to differentiate between rubidium and caesium it is necessary to remove one of them as above, before testing.

This test is paralleled by many others due to the remarkable tendency of rubidium and caesium to form triple halides with the noble metals. For example, rubidium and caesium chlorides give characteristic crystals when treated with an auric chloride, silver chloride reagent. The rubidium-auric-silver-chloride crystals are blood-red tablets or prisms, while the corresponding caesium compound is a star-shaped or cubic non-transparent crystal. Bayer<sup>5</sup> was able to detect 0.1  $\mu$ g. of either ion. The composition of the crystals is indefinite, varying with conditions of precipitation, but closely approximates to  $M_2AgAuCl_6$ .

#### Different Constitution

A different constitution is ascribed to the corresponding iodide compound by Russian workers.<sup>6</sup> They claim that a solution of a rubidium salt in concentrated hydriodic acid yields with addition of equal volumes of a fourteen per cent solution of silver iodide in the same acid, and a four and a half per cent solution of gold in iodine and hydriodic acid a precipitate of black hexagonal crystals having the composition:  $3AuI, AuI_3, 4RbI, AgI$ , when the rubidium is in excess, and:  $3AuI, AuI_3, 3RbI, 2AgI$ , when excess of reagent is employed. The formation of these black crystals is claimed to form a delicate test for rubidium in the presence of potassium and ammonium, the sensitivity being as low as 0.01  $\mu$ g. in one drop of solution under the microscope. Caesium reacts similarly, with a tendency to form star-shaped aggregates of crystals. The test is claimed to be more sensitive than those using the chlorides or bromides of gold and silver, but while this is fairly probable, it is noteworthy that neither these nor other workers comment on the possibility of mixed crystal formation between the rubidium and caesium compounds.

The auric iodide for the above reaction was prepared by allowing gold filings to remain in contact with concentrated hydriodic acid containing iodine and a little ether, for one week. The silver iodide was freshly precipitated and dissolved in hydriodic acid immediately before use.

A mixture of auric and platinum bromides was found to be an excellent reagent for

caesium in the presence of the other alkali metals by Burksev *et al.*<sup>7</sup> As little as 0.25  $\mu$ g. in one ml. could be detected by the formation of a black precipitate of  $Cs_2Au_2PtBr_2$ .

Martini<sup>8,9</sup> has utilised the formation of an insoluble caesium, zinc, auric chloride having a well defined crystalline structure of probable composition  $CsZnAuCl_6$  for the detection of as little as 0.01  $\mu$ g. of caesium. If the zinc is replaced by copper, a light brown isomorphous precipitate is formed.

The test with potassium bismuth iodide is recommended by many workers as one of the most selective for caesium<sup>4,10</sup>. The manner of testing is usually to stir in a small crystal of  $KBiI_6$  to a drop of the test solution. Caesium can be detected in the presence of large amounts of rubidium and the other alkalis by the formation of orange-red, regular hexagons. As little as 0.6  $\mu$ g. can be detected in this way. Bismuth sulphate itself has also been used, in the presence of sulphuric acid, as a reagent for rubidium and caesium. It is claimed<sup>4</sup> that as little as 3  $\mu$ g. of rubidium and caesium can be detected in the presence of amounts of potassium not exceeding 90  $\mu$ g.

Murmann<sup>11</sup> has reported the formation of highly insoluble complexes of rubidium and caesium with magnesium or calcium and ferrocyanides. The precipitate corresponds to the formula  $Cs_2Mg_2(Fe(CN)_6)_2 \cdot 4H_2O$  and is insoluble in ammonia and dilute hydrochloric acid. It is claimed that the test, made more sensitive by addition of alcohol, is the most sensitive for rubidium and caesium, but however this may be, potassium also forms a difficultly soluble compound.

#### Lithium Ferrocyanide

Lithium ferrocyanide in dilute alcoholic solution has been used as a reagent for the metals of the alkali group<sup>12</sup>. The reagent can be made specific for any one metal of the group by carefully controlling the alcohol concentration of the precipitating medium. The alkaline earths also precipitate. Under the microscope the various members of the alkali group can be distinguished under favourable conditions by observing the crystal structure. The fact that each ferrocyanide precipitate can be used as a precipitant for the members of the group below it, is of more practical application than variation of the alcohol

concentration. Thus, for example, a saturated solution of calcium ferrocyanide can be used in 62.5 per cent alcohol as a reagent for strontium and barium, etc.

A much more specific test employing ferricyanide also involves the use of lead acetate<sup>4</sup>. A drop of test solution is evaporated to dryness, and treated with a reagent solution containing a mixture of potassium ferricyanide and lead acetate. A yellow orange precipitate shows the presence of caesium, as little as 0.6  $\mu\text{g}$ . giving a positive test. Apparently rubidium and the other alkalis do not respond to this test, but large amounts of chloride and sulphate interfere.

Moser and Ritschel<sup>19</sup>, after an extensive study of tests for rubidium and caesium concluded that the most sensitive test was that with phosphotungstic acid, closely followed by the cobaltinitrite procedure. Sontos<sup>24</sup> concluded that phosphotungstic and phosphomolybdic acids are very sensitive reagents for rubidium and caesium, and confirmed<sup>19</sup> the test to be superior to those using chlorplatonic acid and cobaltinitrite. Potassium, ammonium, silver, thallium and mercurous ions all give similar reactions, however.

#### Zinc Uranyl Acetate

Although zinc uranyl acetate is used almost exclusively for the detection of lithium and sodium it can be employed for the microscopic detection<sup>16</sup> of rubidium and caesium. While sodium forms isotropic tetrahedra, potassium, rubidium and caesium form tetragonal prisms. Silver, thallium and ammonium react similarly. Uranyl nitrate in admixture with sodium chromate has been used by another worker<sup>17</sup> as a sensitive reagent for potassium, rubidium and caesium. The solubility of the yellow precipitates decreases from potassium to caesium.

A Russian worker<sup>18</sup> has advanced a test based on the formation of crystals of caesium (or rubidium) nickel phosphate. The test was carried out by adding a solution of a nickel salt and disodium hydrogen phosphate to the unknown. The sensitivity appears to be greater for caesium than rubidium, no mention being made of potassium or ammonium. Another possible test arising out of a quantitative method proposed by other workers in this field<sup>19</sup> is due to the formation of white precipitate when a concentrated solution of zirconium sulphate is added to the solution of an alkali

sulphate. This precipitate corresponds to the composition  $\text{M}_2\text{O} \cdot 2\text{ZnO} \cdot 2\text{SO}_4$ , where M can be potassium, rubidium or caesium, but not ammonium, lithium or sodium.

A reagent consisting of a solution of silver nitrate in excess sodium iodide is claimed by Gravestien<sup>20</sup> to be a specific reagent for caesium. The reagent is prepared by dissolving 5 g. of silver nitrate and 20 g. of sodium iodide in 20 ml. of water. In the presence of alcohol, solutions of caesium salts yield a faint yellow precipitate with the reagent. In this way 1 per cent of caesium can be detected in solid rubidium chloride. None of the other alkalis interfere, but dilution of the reagent may cause deposition of silver iodide, which however can be redissolved by adding sodium iodide.

Martini and Rizza<sup>21</sup> have made an extensive examination of many polynitrites of the alkali metals. They give the following sensitivities for various tests:—

$\text{Rb}_2\text{Co}(\text{NO}_2)_6$ —1:	10,000
$\text{Rb}_2\text{BaCo}(\text{NO}_2)_6$ —1:	10,000
$\text{Rb}_2\text{SrCo}(\text{NO}_2)_6$ —1:	10,000
$\text{Rb}_2\text{PbCo}(\text{NO}_2)_6$ —1:	20,000
$\text{Cs}_2\text{Co}(\text{NO}_2)_6$ —1:	10,000
$\text{Cs}_2\text{BaCo}(\text{NO}_2)_6$ —1:	10,000
$\text{Cs}_2\text{SrCo}(\text{NO}_2)_6$ —1:	3,000
$\text{Cs}_2\text{PbCo}(\text{NO}_2)_6$ —1:	20,000.

Sheintsis<sup>22</sup> used pure  $\text{HBF}_4$ , prepared by mixing one proportion of boric acid with 4 equivalents of 40 per cent hydrogen fluoride and distilling off the water to give the 2N acid, to test for rubidium and caesium. No mention is made of sodium, but lithium, calcium and magnesium do not form precipitates. Potassium and barium yield positive tests. The sensitivities for rubidium and caesium are 0.65  $\mu\text{g}$ . and 2.5  $\mu\text{g}$ ., and for potassium and barium 1.25 and 0.06  $\mu\text{g}$ . respectively.

Moser *et al.*<sup>19</sup> observed that there was no truly specific reagent for rubidium and caesium, but that the most reliable test for these metals in the presence of potassium was with silicomolybdic acid.

#### Organic Reagents

Addition of tartaric acid to a neutral solution of rubidium or caesium salts produces a white crystalline precipitate which is readily soluble in mineral acid, but not in water or acetic acid. Winkler<sup>23</sup> observed that this precipitate was the alkali hydrogen tartrate, and that potassium and ammonium reacted analogously.

The test given by Winkler often fails due to supersaturation. Schering<sup>24</sup> found that sodium hydrogen tartrate reacted more efficiently than the free acid, or the free acid buffered with sodium acetate. Lutz<sup>25</sup> claimed that supersaturation could be avoided by adding a very small amount of solution containing one part of potassium nitrate and ninety-nine parts of sodium nitrate. Other workers<sup>26</sup> have recommended the use of racemic acid instead of dextro tartaric acid—the reagent most commonly used—since the former does not show such a pronounced tendency to supersaturation.

Chamot and Mason<sup>27</sup> employed an alcoholic solution of picric acid to test for rubidium and caesium under the microscope, but unfortunately many other ions yield similar crystals, including sodium, ammonium, and potassium; nevertheless Moser and Ritschel<sup>28</sup> found the picrate of rubidium and caesium to be much less soluble than the perchlorates and bitartrates. Unfortunately, the solubilities of the caesium, rubidium and potassium salts are practically identical so that it is not very easy to achieve a separation.

#### No Precipitate Formed

Lithium alone of the alkali metals forms no precipitate with picrolinic acid. A 0.5 per cent solution of the reagent in 50 per cent alcohol is the reagent recommended by Martini<sup>29,30</sup>, who observed that under the microscope, sodium and potassium formed yellow needles similar to those of rubidium and caesium.

Sheintsis found that the sodium salt of hexanitrodiphenylamine gives characteristic precipitates with potassium, rubidium, caesium, thallium and mercuric ions. In later papers<sup>32,33</sup> the test was examined in detail. A 2 per cent aqueous solution of the reagent gave a definite test with potassium solution 0.012N with respect to potassium. Sodium, lithium, magnesium and the alkali earths did not interfere, while aluminium, iron (III) and chromium (III), nickel, cobalt bismuth and mercury (I) gave amorphous precipitates with caesium 0.0005N, rubidium 0.0015N and mercurous ion 0.002N. The magnesium salt of the reagent proved to be superior to the sodium derivative for the detection of rubidium and caesium. Sheintsis' work was subject to criticism by Sapiro<sup>34</sup>.

The majority of organic reagents advanced for the qualitative analysis of rubidium and caesium are used microscopically. For example, Naphthol Yellow was used by Frediani and Gamble<sup>35</sup> in 0.5 per cent solution in pure formic acid to detect rubidium in the presence of caesium, by the formation of yellow acicular needles. Mercury, thallium, tin, silver, lead and copper salts interfere with the test.

#### Test Non-Specific

Dilituric acid<sup>36</sup> (5-nitro-barbituric acid) gives a non-specific rubidium test on the spot plate at a dilution of 1:50,000, but too many ions interfere and react similarly to make the test of any value. 2,4-Dinitrophenol<sup>37</sup> provides a more satisfactory reagent. If it is used in an aqueous solution in 2 per cent sodium carbonate, broad yellow rectangular plates are obtained in the presence of potassium, rubidium and caesium. The other alkalis including ammonium do not interfere, but thallium reacts in the same way. In concentrated solution, magnesium and ammonium ions deposit poorly defined crystals.

2,4,6-Trinitro-*m*-cresol and 2,4,6-trinitroresorcinol, two well-known microscopic reagents for potassium and ammonium<sup>38</sup>, may also be used for the detection of rubidium and caesium. With the first reagent rubidium and caesium yield long yellow rods with branching at the ends into a flower-like spray, while the second reagent causes formation of yellow plates and tablets.

Gillis and Hoste<sup>39</sup> advanced dinitrobenzofuroxan as a reagent for potassium, rubidium and caesium. The solution of dinitrobenzofuroxan in caustic soda is added to the unknown warmed to 60-70°C., and in the presence of potassium, rubidium or caesium, orange orthorhombic crystals are deposited at concentrations of 1:100,000, 1:50,000, 1:10,000 respectively. Separate identification is impossible and cations other than sodium must be removed.

Kuznetsov<sup>40</sup> proposed 4,4'-bis-(2-hydroxy-1,1-naphthyl-azo)-2,2'-stilbene disulphonic acid as a reagent for rubidium and caesium, which gave raspberry-pink and orange-red colours respectively, but the reagent itself has an orange colour, and it is doubtful if the test is of any practical value.

[continued on page 473]



# Corrosion of Copper Powder

## Recent Russian Research

INCREASING attention is being given in Russia to all aspects of corrosion, including the special problems arising in powder metallurgy. Two relatively short papers have lately been published on the corrosion of copper powders: (1) The effect of ammonium salts on the corrosion of copper powder, by A. V. Pomosov and co-workers (*Zhurn. Priklad. Khim. (Jnl. of Applied Chem.)*, 1951, 24 (7), 720-722); (2) Atmospheric corrosion of copper powder, by A. V. Pomosov and A. I. Levin (*ibid.*, 723-726).

The presence of ammonium salts has been found to be a particularly active factor in copper corrosion, whether the metal is powdered or otherwise. In earlier work Pomosov and Levin had studied the effect of two ammonium salts: the chloride and carbonate (*Zhurn. Prikl. Khim.*, 1949, 22 (6), 592), and had expressed the view that the corrosive action of these salts in atmospheric corrosion—even though not actually in contact with the surface under test—was indicated by the volatility of the acid forming the salts. It was decided to extend the work to several other ammonium compounds, including chemically pure halides, the acetate, nitrate, carbonate, sulphate, and phosphate  $(\text{NH}_4)_2\text{HPO}_4$ . The test material was ordinary commercial copper powder (99.92 per cent Cu).

### Test Procedure

Corrosion tests were made as follows: Weighed portions (2.5 g.) of powder in porcelain trays were placed in a 2.5 litre container, and in other trays the ammonium salt and water, the amount of salt being equivalent to 1 g. of ammonia  $(\text{NH}_3)$ . The container was then hermetically sealed with a stopper and paraffin wax and placed in a thermostat, at a temperature of  $40^\circ\text{C} \pm 0.5^\circ$  for 12 hours. At the end of this test period, samples were dried in a desiccator with  $\text{CaCl}_2$  and cooled to constant weight. Rate of corrosion was expressed in mg. per gram of sample in 24 hours, and the corrosion effect of the ammonium salt as percentage increase in weight after test, as shown in Table I which gives the mean values for four experiments in each case. It will be seen that corrosive activity depends on the nature of the acid forming the salt. Actual time of exposure

was 12 hours, but data in the last two columns is based on a 24-hour run. (The original weight of each sample was 2.5 g.)

TABLE I

$(\text{NH}_4^+)$ salt	Weight increase in mg.	Corrosion rate in mg./g. in 24 hrs.	Percentage corrosion effect
Chloride ..	53.2	42.56	2.12
Bromide ..	42.9	34.03	1.71
Iodide ..	43.4	34.72	1.73
Fluoride ..	21.4	17.12	0.84
Acetate ..	90.0	72.00	3.60
Nitrate ..	11.1	8.88	0.44
Carbonate ..	299.9	239.12	12.00
Sulphate ..	9.3	7.44	0.37
Phosphate ..	14.6	11.68	0.58

In so far as atmospheric corrosion is taking place, the rate will be determined by the thickness of the liquid adsorbed layer on the metal surface and by the amount of the vapours and gases dissolved therein (G. V. Akimov—Theory and Methods of Study of Metal Corrosion (*Publ. Acad. Sci., U.S.S.R.*, 1945, pp. 148-150). In the present case the conditions of formation of the liquid adsorbed film with any of the salts tested are identical and therefore its thickness is also uniform, so the observed differences in the rate of corrosion depend entirely on the quantity and nature of the vapours and gases dissolved in the liquid adsorption layer and formed in the reaction space by partial decomposition of the ammonium salts, which varies with their thermal instability.

In the general case, therefore, the corrosive action of these salts is the greater, the lower their thermal stability. The nature of the thermal decomposition is determined by the properties of the acid anions, that is to say their volatility. Salts of non-volatile acids—sulphuric or phosphoric—decompose with formation only of ammonia; while others such as  $\text{HCl}$  or  $\text{H}_2\text{CO}_3$  yield acid vapours in addition, and their corrosive action is much higher. The presence of water vapour facilitates the decomposition of ammonium salts, and obviously the greater the extent of hydrolysis so much more active is this decomposing effect. With ammonium carbonate, hydrolysis is about 80 per cent, and the corrosive activity of this salt is 11.10 per cent as compared with 2.12 per cent for ammonium chloride (hydrolysis 0.14 per cent), 1.71 per cent for ammonium

bromide and less than 1 per cent for the nitrate, sulphate, and phosphate (see Table 1).

It is evident, however, that these factors—the volatility of the acid, the thermal stability of the salt, and its ease or otherwise of hydrolytic splitting, do not exhaust all the diversities and complexities of the problem. Other points which also merit attention are the hygroscopicity of the salt, and the extent to which the acid vapours are soluble in the liquid adsorption film.

In their article on atmospheric corrosion of copper powders (No. 2), the authors first review some of the Russian literature of the past few years or so on corrosion. The action of the atmosphere is held to be a special case of electrochemical corrosion which takes place under a film of moisture (at the surface boundary of the metal and liquid phases) as described by Akimov.<sup>1</sup> The temperature limits are usually those determined by the water present in the liquid state. The corrosive action of dry gases and vapours on metals (chemical corrosion) occurs at temperatures much higher than that of the b.p. of water: for chlorine it occurs above 200°C., for HCl above 300°, for SO<sub>2</sub> and for H<sub>2</sub>S 450–500°.<sup>2</sup>

But in such cases, e.g., with dry H<sub>2</sub>S, it is generally supposed that action takes place with the aid of moisture formed by the reaction of the attacking medium with the metal or the oxide film thereon. Thus the presence of moisture is regarded as an indispensable factor in atmospheric corrosion. According to the film theory of Kistjakovski such corrosion may be regarded as an intermediate field or stage between purely chemical and electrochemical processes, and is in three phases: (a) reaction of the metal with damp oxygen, forming films of metallic

Study of the atmospheric corrosion of metal powders that is of a more specific nature, with some aspects more marked than with ordinary bulk metal, permits a closer approach to the mechanism of corrosion. Earlier research with copper powder in atmospheres of various active gases showed that moisture is indeed a basic factor<sup>3</sup>, and as a result the authors claim to have found a method of protecting these powders from corrosion; for instance, by stabilising them with a hydrophobic agent on the surface of the metal particles<sup>4</sup>. Owing to the formation by chemical sorption of hydrophobic films on the surfaces, adsorption of water vapour on the metal particles is prevented. In other words the formation of liquid adsorption films is completely eliminated. This has proved so effective that in an atmosphere of CO<sub>2</sub> saturated with moisture at a temperature of 40°C. stability of the copper powder was increased 50–70 times.

Work has been continued with copper powder and some further results are recorded here. The methods used were similar to those previously described<sup>4</sup>, and tests were made in desiccators of 2 litres capacity—two samples in each, of which one was made hydrophobic and the other untreated as a control. Test atmospheres were hydrogen sulphide, hydrochloric acid gas, ammonia and carbon dioxide, dried by passage through vessels containing calcium chloride and sulphuric acid, in some cases supplemented with calcium nitrate. In all cases the amount of gas used and the time were identical, and the extent of corrosion was found in the usual way by determining added weight. Some tabulated results with atmospheres of H<sub>2</sub>S and CO<sub>2</sub> dried and saturated with water vapour are as follows (as percentage increases with weight):—

Exposure 8 hrs. Temp. 40° ± 1° C.	Hydrogen sulphide	
	dry	saturated
Ordinary Cu powder	7.72	28.22
Hydrophobised powder	4.21	6.56

Carbon dioxide		Water vapour
dry	saturated	
0.05	0.72	0.33
0.05	0.04	0.002

oxides; (b) solidification partly or wholly of the films (coagulation, crystallite formation); and (c) sorption of gases, condensation of liquids, and colloidal electrochemical processes<sup>5</sup>. Breakdown of the initial film may accordingly be caused by particles vapours and gases suspended in the air. Clearly the presence of moisture occupies a predominant rôle, although corrosion does not proceed entirely as an electrochemical reaction at the metal/moisture film interface.

Similar reductions of weight increase are recorded for other atmospheres, except that with HCl, corrosion was greater in the dry than in the water-saturated atmosphere. (Time of exposure in this case was 4 hours.)

Tests were also made with longer periods of exposure, up to 264 hours, the results of which showed that there was little further corrosion after 24 hours except with the hydrophobised (water-repellent treated) samples. For periods of 24, 48, and 264

hours respectively, percentage increases in weight in a hydrogen sulphide atmosphere were (dry) 6.5, 6.9, 15.2, (wet) 12.2, 10.0, 17.6 per cent. Gas concentration in the reaction sphere also plays an important part, i.e., the extent to which it is absorbed by the moisture present; for the greater such absorption the less intensive is corrosion.

As is well known, metal surfaces stabilised by the application of soap are not fully wetted by water. Interesting results were obtained from wettability tests of samples previously exposed to corrosion. It was found that prehydrophobic treatment of copper powders and prolonged subsequent atmospheric corrosion did not affect their non-wettability with water. It was noted further that samples after corrosion tests deteriorated in storage, those with hydrophobic treatment to a less degree than those not so treated. With the latter, too, there was a much more marked tendency to lumpiness or caking in the presence of water vapour. But in such cases when corrosion exposure had been in a damp atmosphere at relatively high temperatures (90°C.) the caking tendency was much less than when the temperature had been lower. At these higher temperatures there was little difference in deterioration between the hydrophobic-treated and the untreated samples. At ordinary temperatures, therefore, it seems that water has a much more marked effect on deterioration, facilitating conglomeration of particles.

#### Direct Chemical Action

These corrosion tests in various atmospheres ( $H_2S$ ,  $HCl$ ,  $NH_3$ ) have shown without any doubt the presence of atmospheric corrosion in the hydrophobised copper powders, and in the absence of moisture films on the surface of highly dispersed metal particles. It is therefore evident that corrosion is the result of direct chemical action between the gases or vapours and the metal surface.

In regard to the more extensive corrosion of the untreated copper powders exposed to dry  $H_2S$ , this may be explained as follows. Firstly, the gas reaches the entire surface of the particles, whereas with the treated specimens the gas must first overcome or penetrate the protective film; secondly, the water formed from the reaction between the metal and the  $H_2S$  will be adsorbed by the untreated powder and will contribute to the corrosion caused by chemical and electrochemical action.

A similar picture, but a more marked one, is presented when the reaction space is saturated with water vapour, when corrosion of the unprotected metal increases very sharply. In this case a moisture film is formed on the surface not only from chemical reaction between metal and  $H_2S$  but also from adsorption and capillary condensation of water on the highly dispersed metal particles. Both chemical and very intensive electrochemical corrosion then takes place.

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### Less Common Metals

continued from page 470]

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## Copper & Zinc Allocations

FIRST allocations of copper and zinc for the fourth quarter of 1951 were announced on 30 September by the copper-zinc-lead committee of the International Materials Conference, Washington.

Total allocation, to be shared between 35 countries, is comprised of 677,160 metric tons of copper and 469,260 metric tons of zinc, the largest distributions being as follows:—

Copper: United States, 333,770; Britain, 91,690; Germany, 47,100; France, 36,490; Italy, 24,200; Japan, 13,200; Yugoslavia, 4,950; Spain, 3,710.

Zinc: United States 228,460; Germany, 38,520; France, 27,660; Japan 10,530; Italy, 9,390; Britain, 6,250; Spain, 4,020; Yugoslavia, 1,900.

Requirements of copper and zinc for the last quarter of this year were estimated by the committee to exceed refinery or smelter production by about 100,000 metric tons each. This amounted to a deficiency of 15.8 per cent for copper and 21.4 per cent for zinc.

Allocations cover the distribution of primary metal only and are based on the various countries' consumption of the metals in 1950. Priority is given to defence needs, with building up of reserves next, and essential civilian consumption last.

All countries are free to buy from any source and sell to any destination within their allotment.

## Petroleum Industry Exhibition

RESPONSE to the Exhibition of the Petroleum Industry during recent months at the Universities of London, Glasgow, Leeds and Cambridge has led to its being invited to three other university towns. It will be on view, therefore, between October, 1951, and January, 1952, at Leicester, Sheffield and Edinburgh.

Fifth showing of this exhibition will be at the Museum and Art Gallery, Leicester, from 8 October to 27 October. It will then go to the Firth Hall of Sheffield University (8-17 November) where it will form the background to a course of lectures on the petroleum industry, held under the auspices of the University's Department of Extramural Studies. On 17 December the exhibition moves to Edinburgh for six weeks.

## Scientific Staff Win Pay Claim

A CLAIM for fixed minimum scales for male scientific assistants without academic qualifications, aged from 21 to 25, employed in the engineering industry, has been granted by the Industrial Disputes Tribunal, it was announced last week by the Association of Scientific Workers.

Awards made by the Tribunal under the chairmanship of Lord Terrington, were for minimum salaries rising from £6 5s. in London at the age of 21, to £7 15s. at 25, with a corresponding scale 5s. lower for the rest of the country. These rates corresponded with those claimed.

Claims that scientific staff holding a university degree should receive not less than £400 a year and corporate members of a chartered professional institution not less than £600, were found to be not established.

## Semi-manufactures of Copper and Zinc

Restrictions on the exports of semi-manufactures of copper and copper alloys, imposed on 1 April, 1951, are to stay in force for the remainder of the year. The export of semi-manufactures of zinc will continue to be permitted only in exceptional circumstances. Another announcement will be made before the end of the year.

## U.K. Lead Price Reduced

A reduction of £5 from £180 to £175 a ton in the price of good soft pig lead was announced by the Ministry of Materials with effect from 1 October. Arrangements for corresponding adjustments in the controlled prices of scrap, were being made by the Ministry of Supply. There is no change at present in the selling price of zinc.

## Expansion Planned

Forth Chemicals, Ltd., which is at present constructing a plant at Grangemouth for production of monomeric styrene, has decided to proceed at once with an expansion which will substantially increase the projected production of this material. The smaller plant is expected to come into production next year, and the extension about two years later.

Forth Chemicals, Ltd., was formed last year by British Petroleum Chemicals, Ltd. (jointly owned by Anglo-Iranian Oil Co., Ltd., and The Distillers Co., Ltd.) and Monsanto Chemicals, Ltd.

## OVERSEAS

### Aids to Industry

American food chemists have discovered that maleic hydrazide, sprayed on potatoes, onions, and some other vegetables keeps them fresh for one year. Use of salicylic acid crystals in refining cottonseed oil was found to result in a yield of about two per cent more oil.

### International Tin Conference

Important decisions regarding the supply of tin are expected to be made at the International Tin Study Group at present meeting in Rome. An announcement is expected to be made at the conclusion of the conference in about two week's time.

### Sulphur Allocations

Allocations of sulphur for the fourth quarter are expected to be announced shortly by the International Materials Conference in Washington. In the meantime a sulphur industry spokesman is reported by *Cometburro* to have urged the Government of the U.S.A. to reduce exports so that there will be sufficient to cover farm fertiliser requirements. Mr. Margeson, jr., vice-president of the International Minerals & Chemicals Corporation, appearing before a Senate committee, emphasised the need for foreign sulphuric acid manufacturers to hasten their return to the use of pyrites as a replacement for sulphur.

### Norwegian Chemical Plant

Plans for the expenditure of nearly £15,000,000 on new plant were announced recently by Norsk Hydro, Norway's largest chemical company. By an improved electrolysis it is anticipated that annual nitrogen production will be increased by 30,000 tons and nitrates by 200,000 tons. A myosil acid factory is to be built at Heröya, where the first magnesium metal was produced in August, annual production being estimated at 15,000 tons. Plans are also in hand for construction in the near future of a factory to produce 30,000 tons of salt a year, and extension of the company's chlorine factory to increase production from 8,000 to 15,000 tons annually. Talks are also proceeding with the Government with a view to building a factory in northern Norway for the production of phosphorus.

### Oil Refinery for Chile

An \$8 million contract to build an oil refinery at Concon, 20 miles north of Valparaiso, has been signed between Mr. W. M. Kellogg, of New York, and the Chilean Government. The refinery, which will have a capacity of 15,000 barrels a day, is scheduled to be completed by 1953.

### Australian Oil Refinery Project

Construction of an oil refinery in Australia is reported to be under discussion between representatives of Commonwealth Oil Refineries, Ltd., and Mr. G. H. Coxon, a senior executive of the Anglo-Iranian Oil Company. The site has not been settled, but the refinery would be the largest of its kind in Australia and capable of converting between two and three million gallons of crude oil a day.

### Swedish Pulp Industry

The Swedish sulphite industry is concerned with the reduction of Sweden's third quarter allocation of sulphur from a required minimum of 15,000 tons to 11,400 tons, and representatives of the cellulose and chemical industries in Washington have pointed out that Swedish pulp production may drop by 200,000 tons if further allocations cannot be obtained. Home production of sulphur and pyrites may be capable of a gradual increase, they say, but this cannot be done immediately.

Lignin, 30 per cent waste product of wood, has been the subject of research by the Swedish Forest Products Research Laboratory. Practical methods are reported for using it as a soil improvement medium, as a replacement for carbon black in rubber manufacture, as well as a raw material for the production of tans. Successful experiments, partly in collaboration with British firms, have been carried out for preventing the discolouring of bleached sulphite pulp during storage. It has also been found possible to reduce the pitch content of tall-oil distillation to about 10 per cent as against 25-30 per cent previously. A method has been found for the production of cellulose with a high alpha content that might be used favourably for the production of cord silk.

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## PERSONAL

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DR. J. W. M'DAVID, chairman of the I.C.I. Nobel Division, retired at the end of September after 39 years of service with the company. He joined the group in 1912 and has been associated with Ardeer where he has many friends in every section of the industry. Staff workers and foremen of the Nobel Division made presentations on September 25 in the factory. A staff presentation followed and meetings of the Ardeer Recreation Club, a favourite interest of the chairman, completed a busy week.

Dr. M'David will remain a director of Scottish Agricultural Industries, Ltd., and will continue to participate in the activities of the Scottish Council and the Royal Technical College.

MR. W. A. M. EDWARDS has been appointed purchase controller of Imperial Chemical Industries, Ltd., in succession to Mr. R. C. TODHUNTER. Mr. Edwards was educated at Dean Close School, Cheltenham, and Oxford University, and also did one year's research at Berlin University. He joined the General Chemicals Group as a research chemist at Billingham in 1929. After holding a number of managerial positions Mr. Edwards was assistant to the late Sir Frederick Bain as secretary, Chemical Control Board, Ministry of Supply, from 1941 to 1944. In August the following year he became development director of the General Chemicals Division of which he was appointed commercial director in February, 1948.

At the meeting of the Dust Group of the Verein Deutscher Ingenieure at Goslar on 3 and 4 October, DR. R. C. MACKENZIE, of the Macaulay Institute for Soil Research, Aberdeen, will speak on differential thermal analysis and its application to technical dusts, and ROBERT H. S. ROBERTSON will present a joint paper with DR. ING. R. MELDAN, entitled 'The Influences of Morphology on the Technical Properties of Dusts'.

Changes in the board of Monsanto Chemicals (Australia) Ltd., a subsidiary of Monsanto Chemicals, Ltd., were announced last week. MR. T. G. CRANE was elected managing director in the place of DR. JAMES H.

LUM, who is returning to the U.S.A. to take up other duties with the Monsanto Chemical Company. Mr. Crane, who was formerly manager of the technical sales department of Monsanto Chemicals, Ltd., joined the company nearly 19 years ago as an assistant plant chemist. He went out to Australia in December last year as deputy managing director of the subsidiary company. DR. CHARLES A. THOMAS, president of the Monsanto Chemical Co., St. Louis, U.S.A., was elected a director of Monsanto Chemicals (Australia), Ltd., in the place of MR. WILLIAM M. RAND, who retired recently.

MR. IAN FERGUSON, chairman and managing director of Evans Medical Supplies, Ltd., left Liverpool on the *Empress of Canada* on 2 October, for an extensive tour of Canada and U.S.A. Mr. Ferguson's visit follows on the recent visit to U.S.A. of the Pharmaceutical Team sponsored by the Anglo-American Council on Productivity to which Messrs. Evans contributed three members. It is hoped also to stimulate by personal contact his company's contribution to the dollar drive. Mr. Ferguson returns by the *Queen Elizabeth* leaving New York on 14 November.

MR. H. ASHLEY MASON, Overseas Trade Director of Evans Medical Supplies, Ltd., has recently returned from a business trip by air to Latin America, in the course of which he visited Rio de Janeiro, Sao Paulo, Montevideo, Buenos Aires and Asuncion.

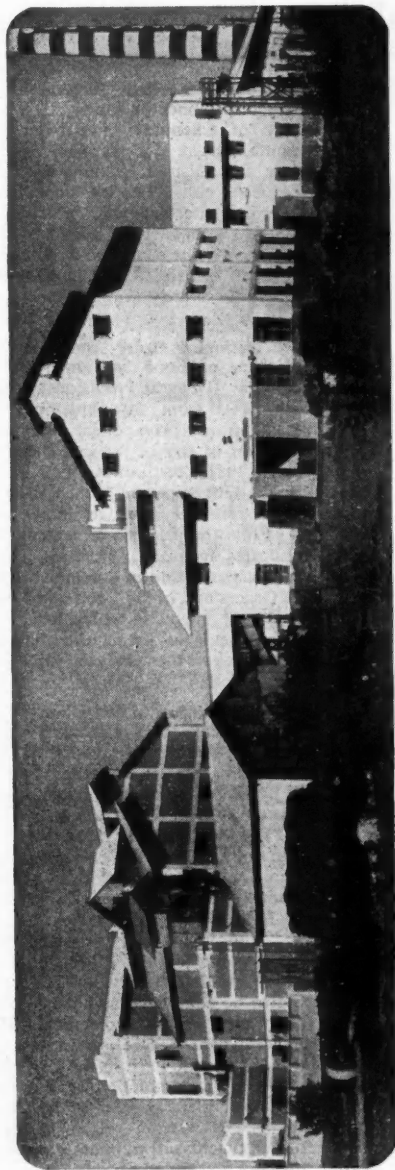
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### Obituary

MR. ONNI O. OJALA, M.Sc., editor-in-chief of The Finnish Paper and Timber Journal and of the periodical Finnish Wood, died in Helsinki on 20 September, aged 55.

Mr. Ojala graduated from Helsinki University in 1920 after which he worked in the employment of Kymi Oy, Oy Keskuslaboratorio and Alinko Kauppa Oy, and as an assistant lecturer at the university. Later he became interested in the activities of many societies and organisations and he was the hon. treasurer of the Delegation of Finnish Chemists, The Finnish Paper Engineers' Association, the Finnish Society of Chemists and a number of other bodies.





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# HOME

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## United Steel Move

The Research and Development Department of the United Steel Companies, Ltd., announce that they have now moved to Swinden Laboratories, Moorgate, Rotherham, together with their secretarial, library and information staffs. Gradually being transferred there from Stocksbridge, near Sheffield, also, are the metallurgical, chemical, physics, X-ray and welding sections.

## New Sunvic Factory

Consequent upon the ever-increasing demands for their products, Sunvic Controls, Ltd., have acquired a new factory on the industrial estate at Harlow New Town. The works and offices previously located at 132/135 Long Acre, have removed to Harlow, where production has already commenced.

The sales department is now situated at 132/135 Long Acre, London, W.C.2, and inquiries and orders should in future be sent to that address. The registered office remains at Sunvic House, 10 Essex Street, Strand, London, W.C.2.

## Census of Production Report

First sections of the final report on the Census of Production for 1948 have now been published. Among those available are: Salt Mines, Brine Pits and Salt Works, 1s. 4½d. post paid; Blast Furnaces, 1s. 4½d. post paid; and Vinegar and Other Condiments, 1s. 7½d. post paid. Copies may be obtained from HMSO branches in London, Edinburgh, Cardiff, Manchester, Bristol, Birmingham and Belfast. Further trade reports will be published at intervals and will be announced as they become ready for publication.

## Sulphuric Acid Prices Raised

The Minister of Materials has made an Order which came into effect on 1 October, 1951, permitting increases in the maximum prices of sulphuric acid. These increases are due to the rise in the price of imported pyrites and in freight rates for both sulphur and pyrites. Additions to maximum prices are 14s. per ton on weak acid (77 per cent  $H_2SO_4$ ) and 27s. per ton on strong acid (more than 84.02 per cent  $H_2SO_4$ ). Copies of the Order, the Sulphuric Acid (Prices) (Amendment) Order 1951. (S.I. 1951, No. 1717) may be obtained from HMSO, price 2d.

## SCI—New Scottish Section

The inaugural dinner of a new section of the Society of Chemical Industry in the Grangemouth area, under the name of the Stirlingshire and District Section, was held at Mathieson's Rooms, Falkirk, on 4 October. The next meeting will be held at Falkirk, jointly with the local section of the Royal Institute of Chemistry, on 17 October. Mr. A. J. Field (British Aluminium Co.) will read a paper on 'Some Chemical Aspects of Metals.'

## Food Rationing Order Amended

The Minister of Food has amended the Food Rationing (General Provisions) Order, 1951, with effect from 30 September, to provide that, in any proceedings relating to an infringement of any of the Food Rationing Orders, 1951, certificates of a public analyst or the Government Chemist shall be receivable in evidence in place of personal evidence. Provision for the acceptance of such certificates in place of personal evidence is already included in a number of the Ministry's Orders and in the Food and Drugs Act. Under the amending Order, a defendant still has the right to require that the person who makes the analysis shall be called as a witness.

## Rayon Expansion at Wrexham

The development at Wrexham Trading Estate of one of the biggest rayon yarn production centres in the country is foreshadowed by the statement that the Ministry of Works have granted building licences authorising the spending of £1,926,000 on the construction of the first section of a vast rayon expansion scheme. The project aims at the production of 15,250,000 lb. of yarn a year by June, 1955. The first section, to be put in hand immediately, provides for building a new factory and other buildings alongside the existing factory. This work is expected to be completed and the factory ready for production by September, 1953. It will be designed to give production of 7,000,000 lb. of acetate yarn in the first year of operation. On completion of the first section, a further plant capable of doubling production will be installed. It is expected that the development will ultimately provide employment for 4,000 people.

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## Next Week's Events

### TUESDAY, 9 OCTOBER

#### **Institution of Works Managers**

Liverpool: Adelphi Hotel, 6.30 p.m.  
Lewis C. Ord: 'Why Nationalised Industry Cannot be Efficient.'

Preston: Starkie House, Starkie Street, 7 p.m.  
J. Ayres: 'The Responsibility of Management in Securing Increased Productivity.'

#### **Society of Instrument Technology**

Manchester: College of Technology, 7.30 p.m.  
J. A. Hall: 'Temperature Measurement at the National Physical Laboratories.'

#### **The Institute of Metals**

Swansea: University College, Metallurgy Department, Singleton Park, 6.30 p.m.  
H. M. Finniston: 'Metallurgical Problems in Atomic Energy.'

#### **Chadwick Public Lectures**

London: Royal Society of Tropical Medicine, 26 Portland Place, W.1.  
F. E. Bruce: 'Some International Aspects of Environmental Hygiene.'

#### **The Institution of Chemical Engineers**

London: Geological Society, Burlington House, Piccadilly, W.1.  
Discussion: 'The Education of the Chemical Engineer by Part-time Study.'

### WEDNESDAY, 10 OCTOBER

#### **Society of Chemical Industry**

Manchester: Reynolds Hall, College of Technology, 6.30 p.m.  
Dr. W. H. Brindley (chairman): 'Retrospect and Prospect.'

London: 11 Upper Belgrave Street, S.W.1, 2.15 p.m.  
Symposium on 'The Use of Isotopes in Microbiology.'

#### **Association of British Chemical Manufacturers**

London: Grosvenor House, Park Lane, W.1, 7 p.m.  
Annual dinner. Chairman: C. G. Hayman.

### THURSDAY, 11 OCTOBER

#### **Society of Leather Trades Chemists**

Northampton: College of Technology, St. Georges Avenue, 2.30 p.m.  
Prof. D. Burton: 'The Parts Played by Salts in Vegetable Tanning, Chrome Tanning and Dyeing.'

#### **O.C.C.A.**

London: The Royal Institution, 21 Albemarle Street, W.1.  
First of three lectures. H. W. Thompson: 'Molecular Dynamics and Chemical Problems.'

#### **The Chemical Society**

Sheffield: Chemistry Lecture Theatre, The University, 7.15 p.m.  
Dr. H. Baines: 'Colour Photography.' (Jointly with R.I.C.).

### FRIDAY, 12 OCTOBER

#### **Liverpool Metallurgical Society**

Liverpool: Lecture Theatre, Electricity Service Centre, Whitechapel, 7 p.m.  
Prof. A. Preece: 'The Problem of the High-Temperature Oxidation of Metals.'

## Market Reports

LONDON.—A steady movement of supplies against contracts continues in most sections of the industrial chemicals market and inquiries for new business have been fairly brisk both for home account and for export. The overall supply position remains restricted and spot requirements are difficult to place. There have been a few price changes reported during the week. Ortho cresol is 4d. per lb. dearer at 1s. 4d. per lb., and the fall in the pig lead price has reduced quotations for red and white lead. The revised prices per ton are: dry red lead £194, ground £125; orange lead £206, ground £227; dry white lead £200 10s.; ground £216 10s.; litharge has also been reduced to £194. A steady call for the coal tar products has been reported. Pitch is in good request for home and for shipment to the continent while a persistent demand has been reported for ADF cresylic acid.

MANCHESTER.—Buying interest in the general run of heavy chemicals has been maintained on the Manchester market during the past week and sellers continue to handle a steady flow of inquiries from home users as well as from exporters. Existing commitments are also being drawn against steadily, especially in the alkali products. This week's reduction in the price of lead has been reflected in the quotations for the lead compounds, but otherwise the market for chemicals remains firm.

GLASGOW.—The demand has intensified over the past week, particularly for solvents and potassium compounds. General chemicals have also enjoyed a very brisk demand and trade on the whole has been extremely good. With regard to export, the demand is there—the difficulty is to meet it—but the overall position appears to be quite sound and satisfactory.



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**A LARGE** Metallurgical and Chemical Company has several vacancies for **QUALIFIED ASSISTANTS** at its works in the London area engaged in non-ferrous process extraction. Applicants should possess a Degree or equivalent qualification, and consideration will be given both to younger applicants without industrial experience or to older men with previous experience. It would be helpful if applicants would state whether they would be prepared to serve abroad at a later date. In addition to the salary the posts carry superannuation rights and marriage and family allowances. Box No. C.A. 3050 **THE CHEMICAL AGE**, 154 Fleet Street, London, E.C.4.

**A VACANCY** exists for a **CHEMICAL ENGINEER** in the development department of a large chemical manufacturers, specialising in the production of inorganic chemicals. The work involves the design and development of processes and equipment for the production of a wide range of chemicals from pilot plant scale to full production. Applicants should have a good basic knowledge of chemical engineering and preferably A.M.I.Chem.E. Applicants should write to Box No. C.A. 3043, **THE CHEMICAL AGE**, 154 Fleet Street, London, E.C.4.

**PROJECT ENGINEER.** A leading firm of Oil Refinery and Contracting Engineers seeks a Project Engineer for an executive position in their London Office. The post offers great scope to the right applicant who, in addition to the essential qualifications stated below, should have had a Public School and University education, be of good presence and health, without family restrictions preventing occasional late working hours and frequent short-notice business journeys. Age limit, 30-45. Salary range, according to age and experience, with excellent prospects. Candidates must possess First Class Honours Degree in Chemical, Mechanical or Industrial Engineering, with experience in the laboratory, pilot plant, process design, project engineering and construction fields; be familiar with specific unit operations and engineering subjects such as hydraulics, heat transfer, distillation, extraction, filtration, conveying, strength and corrosivity of materials, construction methods. Ability to co-ordinate the work of others is equally important as that of direct supervision.

Applications will be ruthlessly scrutinised and the advertiser requests that only those measuring up to the high requirements of this position apply to Box No. 25, c/o A. W. Brown, 37, Totbill Street, S.W.1, giving fullest details to enable a correct preliminary assessment to be made. All communications will be treated in the strictest confidence.

## SITUATIONS VACANT

**CHEMISTS, PHYSICISTS, ELECTRICAL ENGINEERS and BIOLOGISTS** are invited by the **MINISTRY OF SUPPLY** to apply for appointments at the Tropical Testing Establishment, Port Harcourt, Nigeria.

**A 23/51A SENIOR SCIENTIFIC OFFICER**, to lead a group of physicists and engineers studying the effects of tropical conditions on Service materials and equipment. Candidates should have a 1st or 2nd Class Honours Degree in Physics or Electrical Engineering or equivalent qualification, and experience of radio communications or of methods of physical and mechanical testing.

**F 686/51A SCIENTIFIC OFFICER**, to work on analytical or biochemical investigations in connection with deterioration of equipment under tropical conditions. Candidates should have a 1st or 2nd Class Honours Degree, or equivalent qualification, in Chemistry, with experience of Micro-analysis or Biochemistry.

**G 349/51A SENIOR SCIENTIFIC OFFICER** or **SCIENTIFIC OFFICER** to study the biological attack on materials and equipment under tropical conditions. Candidates should be biologists with a 1st or 2nd Class Honours Degree in Botany or Zoology, or equivalent qualification, and with post-graduate research experience in Mycology, Microbiology, Entomology or Biochemistry. For the senior grade candidates must be at least twenty-six years of age and have had at least three years' post-graduate research experience. Posts A 23/51A and F 686/51A are open to men only and married quarters are available.

Appointments are for an initial tour of eighteen months, but further tours may be arranged by mutual agreement. Consideration will be given to further employment in U.K. at the end of service in West Africa.

Salaries will be assessed on age, qualifications and experience, within the following ranges: Senior Scientific Officer, £750-£950; Scientific Officer, £400-£650. Rates for women are somewhat lower. The posts are unestablished, but carry benefits under F.S.S.U. In addition, a Foreign Service Allowance is payable, varying from £200 to £350 per annum, according to marital status. Subject to certain conditions, passages by sea from the U.K. can be provided at public expense for families. A detailed explanation will be given to candidates selected for interview.

Application forms obtainable from **Ministry of Labour and National Service, Technical and Scientific Register (K)**, York House, Kingsway, London, W.C.2, quoting the appropriate reference number. H.Q. 670-30 9/51 M.M.

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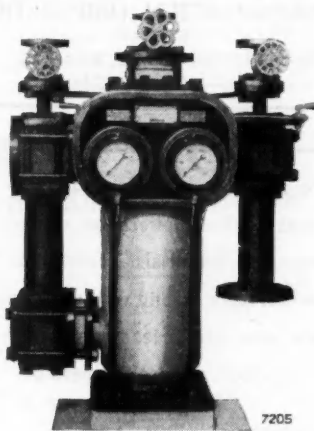
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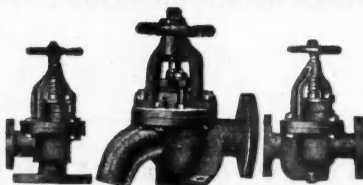
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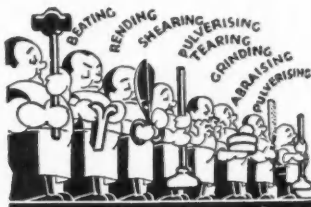
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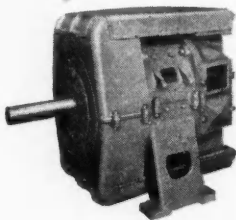
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